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SYMMETRICAL FIGURES IN BIRDS' FEATHERS.

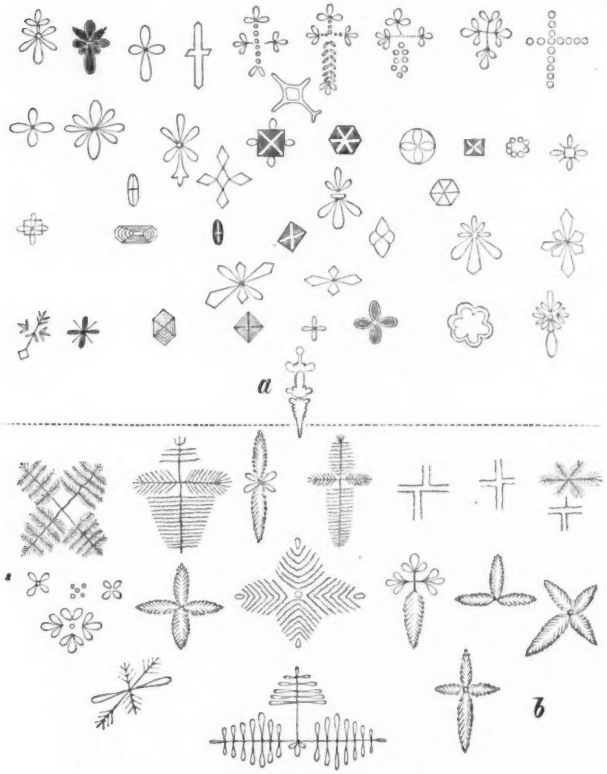
BY GRACE ANNA LEWIS.

In the summer of 1869, whilst examining the feather capsule of a nestling dove, the microscopic slide was suddenly covered with a multitude of exquisite forms. Lost in admiration of the beauty of these brilliants, as seen under the effects of sun-light, for a time I forgot every thing else, but presently remembering that others might enjoy the sight as much as myself, I seized a pencil and rapidly transferred the outlines to paper, continuing until twilight obscured them from view. Resting for an hour, I returned to my microscope, but all had vanished like a dream,—nothing was left but a few drops, looking like perspiration on the face of the glass.

The next day my German farmer climbed to the dove's nest and procured a few more pen-feathers. Some of these were cut into fine shreds, rubbed in a drop of water, and placed under the microscope. In a short period the figures of yesterday were again before me. From the cut surfaces of the portions of the pen-feathers I had placed under the lens, granules appeared to stream forth like blood, covering the microscopic slide in countless numbers. Mingled with these were numerous larger cells of a globular or oval form, having a transparent centre. These and the granules, gave to the water a slightly glutinous consistency. As the fluids on the glass dried, lines at different angles shot across the slide, looking much as though an unseen camel's hair pencil

had been swiftly drawn in opposite directions, sometimes at right angles but frequently at angles more acute. Probably, at the moment of transition from a fluid to a solid condition, the transparent centred, or nucleated, cells assumed the form of a square,

Fig. 119.



Symmetrical Figures in Birds' Feathers.

a lozenge, a starry hexagon, a cross, or any other beautiful figure which could be formed of the parts which suddenly appeared in the spherical cells, these parts seeming at first, in some instances, at least, to consist of minute triangles.

At the same moment the little granules moved to order, and

there before the astonished gaze were diamonds such as Aladdin might have envied, in form as varied, but far more symmetrical than the frost work on a window pane of a winter's morning.

Some of the figures, as I afterwards found on repeated trial, retained their outlines for several hours, in a few instances for days, even when exposed to the moisture of the atmosphere. When examined by lamp-light many, but not all, cast an undoubted shadow. The exceptions appeared to be symmetrical *depressions* instead of raised figures.

These figures must, of course, be common to skilled microscopists. It is not at all probable that forms due to universal causes should remain unseen ever since the invention of the microscope, but to me they were a new revelation, and I watched their formation with intense interest, as the work of polarizing forces whose operation is co-extensive with the universe, and to which all things material are subjected. As the law of gravitation may be observed in a drop of dew as well as in the circling orbs, so it seemed possible for these tiny jewels to elucidate principles of farthest reaching power.

The frost work, annually repeated, is not less beautiful or interesting because it is common, nor do snow crystals grow unlovely because we have seen them before;—the value of neither is lost when they are perceived to be related to certain other symmetrical forms, but on the contrary, all the members of the related groups rise in importance when they are understood to be varying expressions of one eternal omnipresent law of matter,—operating alike in dead and living forms, but according to modes peculiar to unorganized or to organized matter.

One very beautiful form is not given in the cut. It was less distinct then the rest and I waited for a better example to copy. It never appeared again. It was a circle with ornaments at four opposite points, but as I cannot remember the exact style of the ornament, I do not venture to give even a suggestion of the figure. Other very beautiful designs were lost in the same way. Water containing material from the feathers of the common barn-door fowl produced, mainly, simple crosses, the lines usually crossing in the middle, but even in this, some beautiful six-rayed forms were seen. The feathers of the domestic turkey yielded more arborescent forms, as those seen at *b*, which are larger and stronger than those afforded by the feathers of the dove, shown at *a*.

The majority of these symmetrical figures do not possess the sharp outline of crystals, whilst others can doubtless be referred to the mineral salts held in solution in the composition of the feather. There are both rounded and sharply defined figures,—a fact which any one can verify by the microscope. If I am not mistaken, the crystalline forms are derived from the nucleated cells, and the rounded figures from the granular matter.

Of the conditions necessary to produce these forms I know absolutely nothing. I have never yet succeeded in obtaining them from feathers which had long been removed from the *living bird*. This, however, proves nothing as I have frequently failed to procure any from freshly dropped or plucked feathers, which yield them most readily. Of different cuttings from the same feather made during the same minute, and apparently subjected to the same treatment, some presented figures whilst others did not.

BULLOCK'S ORIOLE.

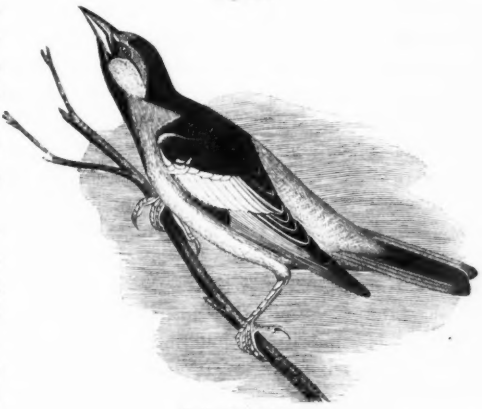
BY ELLIOTT COUES.

ALTHOUGH the beautiful bird referred to in the works cited* has been known by name for nearly half a century, no complete biography has yet appeared; and doubtless many readers of the NATURALIST will be glad to have such information as we can furnish from our study of its habits. We will premise that it is a near relative of the Baltimore oriole, or fire-bird, or hangnest, as it is indifferently called; a bird whose striking colors and brilliant vocal powers, together with its abundance in our streets and orchards, have made it a well-known favorite. Like the Baltimore, it is chiefly black and orange in color, but it differs in having a large white patch on the wings, and the sides of the head and neck orange instead of black. The female, as in all the orioles, is smaller than the male and with hardly a trace of his

**Xanthorthus Bullockii* SWAINSON, Phil. Mag. i, 1827, p. 436.—AUDUBON, Orn. Biog. v, 1839, p. 9, pls. 388, 433, and 8vo, ed. iv, 1842, p. 43, pl. 218.—Pacific Railroad Reports, vi, 1857, p. 87; ix, 1858, p. 549; x, 1859, p. 52; xii, 1859, p. 209, and Mex. Bound. Survey, ii, pt. 2, 1859, p. 20.—COUES, Proc. Acad. Nat. Sci., Philada., 1866, p. 55.—COOPER, Cal. Birds, i, p. 273.—*Psarocolius auricollis* of MAXIMILIAN.

brilliant hues, being plain olive-grey above and whitish beneath with pale yellow on the head, breast and some other parts. The young male at first resembles the female. This is only one of countless cases in which the sexes bear such relations in color. The mother-bird, almost defenceless amidst many dangers, and wholly incapable of protecting her young, is shielded by her humble garb, matching the foliage in which she lives, that she may pass to and from her nest unobserved, and accomplish her important maternal offices in safety. We may judge how well this beneficent design is accomplished, by a glance at any of our large collections where this species is represented; for a dozen or more of the richly attired males will be found for one of the female.

Fig. 120.



Bullock's Oriole.

Of the many beautiful orioles that inhabit Tropical America, only two—the Baltimore and the orchard—range northward through the Eastern United States. In the west, several kinds reach our southern borders, but Bullock's is the only one that proceeds further north. Its distribution in the west corresponds, in a general way, with that of the Baltimore in the east. It inhabits all the wooded portions of the Rocky Mountain and Pacific regions of the United States; in most of its range it is separated from the *habitat* of the Baltimore by the intervening treeless Central Plateau, though the two species approach closely, if indeed they may not be found together, along the Upper Missouri. We have no record of its reaching into British America, but should not be surprised to learn that it extends its range beyond the United States in summer. Being strictly a migratory species, like all of its family, it passes south in the fall, to winter in the

warmer parts of America. It appears in Lower California in March, but does not complete its migration into the United States until some time in the following month, when the forests it loves to dwell in are clothed with verdure. In the pine clad mountains of Arizona and New Mexico, we never saw it until about the middle of April; then, and until the cool weather of September, we were almost daily gratified with the sight of the gaily-hued birds gleaming through the sombre foliage like tiny meteors, and with the sound of their musical voices awakening echoes along the deepening aisles of the woodland.

In the countries just mentioned, the belts of thick cotton-wood and willows that generally fringe the streams are favorite resorts, perhaps because the pliant twigs are best suited to their wants in constructing their nest. All the orioles are wonderful architects, weaving pensile nests of soft pliable fibrous substances with a nicety and beauty of finish that human art would vainly attempt to rival. These elegant fabrics are hung at the end of slender twigs, out of reach of ordinary enemies; and though they may swing with every breath of wind, this is but cradle-rocking for the callow young, and it is a rude blast indeed that endangers the safety of their leafy home.

Little time passes after their arrival before the modestly-attired females, rambling silently through the verdure, are singled out and attended each by her impetuous consort, who sings his choicest songs, and displays the prowess she admires most. His song is an elegant paraphrase of the Baltimore's, with all its richness and variety, though an ear well skilled in distinguishing birds' notes can readily detect a difference. Their courtship happily settled, the pair may be seen fluttering through the thicket they have chosen, in eager search for a building-place; and when a suitable one is found, no time is lost in beginning to weave their future home. It is a great mistake to suppose that birds of the same species always build in the same way. Though their nests have a general resemblance in style of architecture, they differ greatly according to their situation, to the time the birds have before the nest must be used for the reception of the eggs, and often, we are tempted to think, according to the taste and skill of the builders. In their work of this sort, birds show a remarkable power of selection, as well as of adapting themselves to circumstances; in proof of which we have only to examine the three beautiful specimens now lying

before us. Each is differently constructed; and while all three evince wonderful powers of weaving, one of them in particular is astonishingly ingenious, displaying the united accomplishments of weaving and basket making. Before proceeding, we may premise that the idea of the nest is a sort of bag or purse, closely woven of slender pliant substances like strips of fibrous bark, grasses, hair, twine, etc., open at the top, and hung by its rim in the fork of a twig or at the very end of a floating spray.

The first nest was built in a pine tree; and if the reader will call to mind the stiff nature of the terminal branchlets, each bearing a thick bunch of long straight needle-like leaves, he will see that the birds must have been put to their wits' end, though very likely he will not be able to guess how they made shift with such unpromising materials. They made up their minds to use the leaves themselves in the nest, and with this idea they commenced by bending down a dozen or twenty of the stiff slender filaments, and tying their ends together at the bottom. If you have ever seen a basket maker at work, with his upright pieces already in place, but not yet fixed together with the circular ones, you will understand exactly what the birds had thus accomplished. They had a secure framework of nearly parallel and upright leaves naturally attached to the bough above, and tied together below by the bird's art. This skeleton of the nest was about nine inches long, and four across the top, running to a point below; and the subsequent weaving of the nest upon this basis was an easy matter to the birds, though, if one were to examine a piece of the fabric cut away from the nest, he could hardly believe that the thin yet tough and strong felting had not been made by some shoddy contractor for the supply of army clothing. Yet it was all designed in a bird's little brain, and executed with skilful bill and feet.

Perhaps the young birds that were raised in the second nest did not appreciate their romantic surroundings, but their parents were evidently a sentimental pair. If they did not do their courting "under the mistletoe," at any rate they built a cozy home there, tinting the sober reality of married life with the rosy hue of their earlier dreams. The nest was hung in a bunch of the *Arceuthobium oxycedri*, an abundant epiphytic plant that on the western wilds represents the mistletoe, and recalls the cherished memories of holiday gatherings. The nest was a cylindrical purse some

six inches deep and four broad, hanging to several sprays of the mistletoe, which were partly interwoven with the nest to form a graceful drapery. The felting material was long, soft, vegetable fibre of a glistening silvery lustre, in artistic contrast with the dark-hued foliage. A few hairs were sewn through and through, for greater security, and the pretty fabric was lined with a matting of the softest possible plant-down, like that of a button-wood or an Asclepias.

The general shape and the material of the third nest were much the same as those of the last; it was, however, suspended from the forked twig of an oak, and draped almost to concealment with leaves. But it had a remarkable peculiarity, being arched over and roofed in at the top with a dome of the same material as the rest, and had a little round hole in one side just large enough to let the birds pass in. Such a globular nest as this is probably exceptional; but now it will not do to say that orioles always build pensile pouches open at the top.

The eggs of this species are four or five in number, and rather elongated in form, being much pointed at the smaller end. They measure on an average just an inch in length, by about two-thirds as much in greatest diameter, which is much nearer the larger than the smaller end. In color they are very pale bluish, or rather whitish with a faint dull blue shade, and are everywhere irregularly overrun with fine sharp hair lines of blackish brown, or blackish with a slight tinge of purplish. These curious zigzig markings are characteristic of the eggs of a majority of the birds of the family (*Icteridæ*). They have no definite style, but wander at random over the surface, and in no two specimens are they alike. Thus in one specimen the lines, fine as hairs, are wound round and round the butt, with such regularity that they hardly ever interfere; in others, they are snarled up in different places; and sometimes, particularly at a sharp turning-point, the lines spread into little spots; and there are often a few such isolated markings in various places over the egg.*

We need say nothing of the general habits and manners of Bullock's Oriole, for it does not differ from the well-known Baltimore bird in these respects.

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*The nests and eggs above described were collected in California and are now in the Smithsonian Institution, where we have been generously allowed to examine them.

THE CHINESE WHITE WAX INSECT.

BY PROFESSOR B. SILLIMAN.

We find the following note on this insect (a species of Coccus) in an interesting volume by T. T. Cooper.* Chemists have long known the so-called "vegetable wax," "Chinese wax" or "pela," also called "vegetable insect wax," or "vegetable spermaceti," but we have had no definite knowledge before of its history or mode of production.

It was generally stated to be produced on certain trees by the puncture of a species of Coccus. But Mr. Cooper supplies us with the first definite statement we have seen of what proves to be an extensive, and to us novel, industry. Unfortunately, he does not appear to have secured specimens of the insects producing it, nor does he give us more definite information of the plant on which they feed than that it resembles our privet.

It may be interesting to non-chemical readers to know that this insect wax is a definite compound somewhat resembling spermaceti in appearance but not in composition, being a *Cerotic ether* known as *Cerotate* of *Ceryl* of the formula $C^{59}\ H^{108}\ O^2$. It is crystalline, and of a dazzling whiteness like spermaceti, but more brittle and of a more fibrous texture. It does not completely saponify by boiling in potash water, but is completely decomposed when melted with potash, yielding cerotate of potassium and hydrate of ceryl. It is consumed in China for candles and also as a medicine. It melts at about 118° F. It does not appear clearly from the statements of Mr. Cooper, whether this wax is secreted by the insect or is not rather an exudation from the stems of the trees punctured by the insect. Mr. Cooper plainly favors the former supposition; but other writers of more pretensions to science entertain the opposite view. The plant on which the Chinese Coccus lives is stated to be *Ligustrum lucidium*.

There are several sorts of vegetable wax well known to chemists and new to commerce, and we find it stated by Rev. Justin Doolittle in his "Social life of the Chinese" that the "vegetable

*Travels of a Pioneer of Commerce in Pig Tail and Petticoats, on an overland Journey from China toward India. By T. T. Cooper. London. Murray, 1871. 8vo, pp. 471.

tallow" of China is obtained from the seeds or kernels which grow upon the so-called "Tallow Tree." But he also states that this tallow is hardened by a very hard white wax brought from the western or northwestern provinces of China, which is the very wax described by Mr. Cooper. The 'tallow' is not a wax in chemical constitution, and is the product of a shrub known as *Stillingia sebifera*. Our American myrtle wax (bayberry tallow) is a solid fat melting at about 118° F. and contains a large quantity of palmitic and a small quantity of myristic acid (Moore, Sill. Jour: [2] xxxiii,113.)

From its high melting point and general physical and chemical properties we might infer that the white wax of China was the product of the Coccus, rather than of the plant on which it feeds, seeing the properties alluded to are more like those of bees' wax than of vegetable wax, known to be such. But of this we still lack the proof. Probably some of your entomological correspondents may know the wax producing, or provoking, Coccus.*

Our quotation from Mr. Cooper's instructive volume is as follows:—

"On the third day we entered the white wax country so named from its producing the famous white wax of Szchuan, which has been erroneously called vegetable wax. This district was less undulating than that of the tea gardens, and presented to the eye a view of extensive plains surrounded by low hills. The plains were all under wax and rice cultivation, the wax trees being planted round the embankments of the small paddy fields which were at most thirty yards square. The country thus presented to the passing traveller the appearance of extensive groves of tree stumps each as thick as a man's thigh and all uniformly cut down to a height of about eight feet, without a single branch. The cultivation of wax is a source of great wealth to the province of Szchuan, and ranks in importance second only to that of silk. Its production is not attended with much labor or risk to the cultivator. The eggs of the insect which produces the wax are annually imported from the districts of Hochin or HoKing and Whyli-tzou in Yunnan (where the culture of the eggs forms a special occupation) by merchants who deal in nothing else but Pa-la-tan "white wax eggs." The egg clusters which were described to me

* Westwood (Modern Classification of Insects ii. p. 449) writes thus: "The *Coccus ceriferus* Fabr., described by Anderson in his letters from Madras (1781) and by Pearson in the Phil. Trans. 1794, is employed in the production of a white wax, the body of the females being enveloped in a thick and solid coat of wax." It is now known that this wax as well as that of the honey bee is secreted by numerous minute secretory sacs or follicles lodged just beneath the skin of the abdomen.—EDS.

as about the size of a pea are transported carefully packed in baskets of the leaves of the Pa-la-shu, "white wax tree," which resembles a privet-shrub, and arrive in Szchuan in March, where they are purchased at about twenty taels per basket. The trees by the middle of March have thrown out a number of long tender shoots and leaves, and then the clusters of eggs enclosed in balls of the young leaves are suspended to the shoots by strings. About the end of the month the larvæ make their appearance, feed on the branches and leaves and soon attain the size of a small caterpillar or rather a wingless house-fly apparently covered with white down, with a delicate plume-like appendage, curving from the tail over the back. So numerous are they that as seen by me in Yunnan, the branches of the trees are whitened by them, and appear as if covered with feathery snow. The grub proceeds in July to take the chrysalis form, burying itself in a white wax secretion, just as a silkworm wraps itself in its coccoon of silk. All the branches of the trees are thus completely coated with wax an inch thick, and in the beginning of August are lopped off close to the trunk and cut into small lengths which are tied up in bundles and taken to the boiling houses, where they are transferred without further preparation to large cauldrons of water, and boiled until every particle of the waxy substance rises to the surface; the wax is skimmed off and run into moulds in which shape it is exported to all parts of the Empire.

It would seem that the wax growers find that it does not pay them to reserve any of the insects for their reproductive state, and hence the necessity of importing the eggs from Yunnan. In the district of Ho-chin and Why-li-tzou, where the culture of the eggs is alone attended to, both frost and snow is experienced, so that it would not be difficult to rear the insect in Europe, and considering its prolific nature, the production of white wax might repay the trouble of acclimatizing this curious insect."

INSTRUCTION TO SCIENCE TEACHERS AT SOUTH KENSINGTON.

During the months of June and July, a number of science teachers from various parts of England, Scotland, and Ireland, were assembled in London, for the purpose of attending special classes, arranged for their instruction under the auspices of the Science and Art Department. We propose to give some account of the course of instruction in the principles of Biology

which was directed by Prof. Huxley, to whose suggestion, we believe, liberally accepted by Mr. Forster, and acted upon by the government, this important scheme for raising the character of science teaching in the various schools and classes at present in relation with South Kensington is due. It had long been felt by those who annually examined teachers and pupils for certificates in various branches of science, under the Science and Art Department, that the candidates displayed a sad want of practical acquaintance with the subjects in which they presented themselves for examination: many showed considerable ability and great book knowledge, but a knowledge of the things themselves with which science deals, a proof of personal intercourse with Nature, which after all is the only foundation of scientific knowledge, and without which all 'the 'ologies are so much book-wormery, was to a very great extent wanting. Under the existing state of things it seemed almost impossible to get out of this vicious condition, for the scholars who were in their turn destined to become teachers were for the most part taught by men who were deficient in practical knowledge; and with the increasing demand for science teaching there appeared to be a probability of the evil being increased by the rapid accession of the book-taught students to the position of instructors. The only way to meet this difficulty was to find teachers who had the requisite familiarity with the "solid ground of Nature," and set them to work to leaven the mass. The readiest means of doing this was undoubtedly that adopted by the authorities — namely, to summon to a central class, the ablest of the teachers at present distributed throughout the kingdom, and to impart to them as much practical acquaintance and personal familiarity with the *things* of which they had read in books, as was possible in a given time. By annual repetition of this plan there can be little doubt that the body of science teachers throughout the country would be materially affected. Being already acquainted with the outlines and much of the detail of their subjects by hearsay, they would readily understand and appreciate the facts and methods of investigating facts placed before them, and after passing through such a course of instruction would be prepared to proceed further in the same direction by their own individual efforts, and what is more important, to teach, not at second-hand, but from experience, not as fluent repeating machines but as thoughtful students of phenomena.

Thirty-nine students of whom one was a lady, attended the course of instruction in the principles of Biology, their expenses (involved in coming to London) being defrayed by the Government. The course occupied six weeks: the students attended every day, with the exception of Sundays, from ten in the morning until half-past four in the afternoon (Saturdays until two). Each morning at ten o'clock a lecture, occupying from an hour to an hour and a half, was given by Prof. Huxley, and the remainder of the day was employed in dissection, microscopic work, and demonstrations, in carrying out which Prof. Huxley was assisted by Prof. Michael Foster, Prof. Rutherford, and Mr. Ray Lankester. The students were placed in pairs at large working tables, and each table was provided with a microscope (with inch and one-eighth inch objectives, and two eye-pieces furnished with micrometric square-ruling), with four scalpels, two pairs of scissors, two pairs of forceps, pins, thread, dissecting needles, watch-glasses, beakers, pie-dishes, glass-tubing, and camel's-hair brush.

The practical instruction proceeded *pari passu* with the lectures, the students at once taking their places at the tables after the lecture, and setting to work at materials provided for them to dissect or examine with the microscope in illustration of, or rather as the sequel to, the lecture which they had just heard. Each student was required to send in full reports and drawings as the result of his day's work, many of which proved very excellent; an abstract of the lecture was also given in by each student with the report of his practical work, and the lot were returned at the end of the course (after due examination by the lecturers) to the students for their future reference.

Two prizes — which were two microscopes similar to those used by the members of the class, and provided like them with inch and one-eighth inch objectives — were offered to the students who should be considered to have done best during the course, especial weight being given to excellence in the practical work, as judged both by observation of the student when at work, and by the reports sent in.

The names of the students were placed in two classes of merit at the termination of the course, arranged in alphabetical order.

Now as to the subjects which were gone over in the time, which though limited to six weeks, yet by dint of hard work, was made to take in more than many a six months' course. The yeast

plant occupied the first lecture and each student was provided with some yeast, which was carefully examined and drawn under the microscope. Each student sowed some in Pasteur's solution which he had himself prepared, and on the following day studied its germination. In like manner the Penicillium mould was studied, sections being cut through the crusts, and careful drawings made of mycelium, hyphæ, conidia, etc. The latter were sown, and their development accurately observed and drawn by each student. A solution of hay was given to each, and the formation of a Bacterium film was studied, the form and movements of Bacteria were compared with the Brownian movements of gamboge rubbed up in water. The structure of the higher Fungi was then studied in specimens of a common toad-stool, and thus a general notion of the morphology and life-history of the Fungi was obtained. Protococcus in its various stages, Palmella, and Volvox next formed the subjects of lectures and practical work, and from these simpler forms the students passed on to Spirogyra and Chara. In Chara the advance in cellular differentiation was noted by each student on specimens supplied to him, and the male and female reproductive bodies examined in detail, and the Antherozooids were obtained in active movement. The phenomenon of cyclosis was also very carefully gone over, each student comparing that of Chara with that seen in Valisneria and in the hair of the nettle and of Tradescantia; drawings and descriptions being made and the specimens prepared by every student for himself. During this time a certain amount of familiarity had been obtained by all with the use of the microscope—not half a dozen of the class, be it remembered, having previously ever used the instrument at all, still fewer one of adequate power—and as well as the instrument itself, the use of various reagents had been learnt, such as iodine-solution for demonstrating starch, and for delineating protoplasm, acetic acid, magenta-solution, etc. From Chara the class proceeded to the study of the Fern—the sori and sporangia were examined in the first place, and the general form of the fern-frond; then each student was provided with spores which had been previously allowed to germinate, of two stages of development, the one set with the quite young pro-embryo-like prothallium, the other more advanced exhibiting numerous archegonia and pistillidia, the structure of all of which were examined and drawn; and in many cases active antherozooids were obtained.

The structure of the fern stem followed, exhibiting typical scalariform, dotted and spiral ducts and other forms of tissue; also the leaf of sphagnum; the methods of recognizing starch and cellulose being here again used. From the fern the class passed on to the study of a bean plant as typical of a phanerogam. Its general morphology, the microscopic structure of its tissues, the minute structure of the flower and the histology of the essential reproductive organs were examined during three consecutive days, and finally the development of the seed and the growth of the young bean plant were studied.

In this work each student used a razor for making sections of the parts to be studied, and portions of turnip were made use of for embedding delicate pieces of tissue, such as leaves, in order to facilitate the cutting of thin sections. A few typical flowers (*e. g.*, Campanula, Rosa, Viola, various Orchids) were next studied as examples of the kind of modification of parts exhibited by phanerogamous plants and also the female flowers of a small Conifer. Before proceeding to the animal kingdom, a lecture was devoted to a retrospect of the steps through which the class had passed from the simple to the more complex forms, a comparison of the various methods of reproduction, and an outline of the physiology of vegetable life.

Amœbæ, the colorless corpuscles of the Triton's blood, and the amœboid particles of Spongilla were the first examples of animal life studied, each member of the class making drawings of the various forms due to protoplasmic movement presented by an individual example of each of these cases of simple organism whilst in the field of his microscope. The Gregarinæ of the earth-worm next occupied a day, and every student was able to observe and draw the actively moving nucleated Gregarina, its simple encysted condition, and its various stages of breaking up into pseudonaviculæ.

The structure of Infusoria was next examined, as exemplified in Vorticella and Vaginicola, the nucleus, contractile vacuole, mouth, etc., being fairly observed and drawn by all the students. Specimens of Hydra were provided, on the following day, and the endoderm and ectoderm, thread-cells and reproductive organs studied. To this followed a copious supply of *Cordylophora lacustris* (from the Victoria Docks), in which the class were able to study a typical compound Cœlenterate, and to recognize not only

the male and female gonophores, but the larval "planula-form" as it escaped from the reproductive capsules. Plumatella as a typical Bryozoon succeeded this, and then two days were given to the dissection and histology of Anodon, of which each student was provided with two or three specimens. The lobster as a typical Arthropod was then examined, a fresh specimen being supplied to each table; the heart and vessels were first studied, then the alimentary canal, liver, reproductive organs and green glands. A large piece of mill-board covered with paper was used by each pair of students for placing out in order, numbering, naming and comparing the twenty somites and their appendages, an instructive preparation being thus made. The corresponding parts were again examined, and the microscopic structure of the muscular tissue, blood, liver, and gills, in specimens of the river cray-fish. The careful dissection of the frog next occupied some days and to this succeeded the rabbit.

Simultaneously with the dissection of these vertebrata, the study of the microscopic structure of the various tissues and organs was commenced, so that whilst one student was using the microscope, his companion at the table was dissecting, and *vice versa*. The blood of the frog and of man, the movements of the colorless corpuscles in both cases, and the action of acids on them, the varieties of epithelium, the various forms of connective tissue and its corpuscles, cartilage, bone, muscular tissue smooth and striped, nerve fibres and cells, the termination of nerve in muscle, and the structure of the more important organs, were examined by the class, *not* in already prepared and mounted "slides," but in specimens which each student took for himself, usually from the animal under dissection, and treated with various reagents, the methods of cutting thin sections and embedding tissues in wax or paraffin being learnt at the same time.

A simple injecting apparatus (formed by two Wolff's bottles and a large vessel of water) was put up, and the method of injecting a frog shown to each student. The best part of a day was spent in a thorough dissection of a sheep's heart, and another in the dissection of the sheep's larynx. Vertical antero-posterior sections of the sheep's head were supplied to the various tables, and in these the parts of the brain and cranial nerves (already made out in the rabbit), the tongue, the relations of the cavities of the mouth, nose, and ear, the ducts of the salivary glands, and the muscles of

the eye were studied. The structure of the eye was again examined by each student, in specimens of those of the bullock, supplied in quantity, and the internal ear and auditory ossicles were demonstrated in rough preparations of the sheep and rabbit.

But little time could be afforded to physiology; and, indeed, it was hardly possible that each member of the class should perform many physiological experiments for himself. The movements of the heart in the frog after excision, and the localization of the nerve-centre, was made out by each student for himself; also the phenomena of reflex action in the frog, after the destruction of the cranial portion of the cerebro-spinal nervous system. Again, each table was supplied with simple galvanic forceps, and the irritation of nerve and of muscle examined, also the action of chemical and mechanical stimuli on the nerve. The action of curare poison on the frog (Bernard's experiment) was examined by every student, and the condition of the poisoned and the unpoisoned leg compared. Every member of the class was made familiar with the simplest way of demonstrating the circulation in the frog's foot, tongue, and mesentery, under the microscope, and repeatedly examined the phenomenon for himself. Rigor mortis and the artificial rigor produced by warm water were examined. The conversion of starch into sugar by the saliva, and the methods of proving the presence of starch and grape sugar, were made the subject of experiment by every individual of the class. The peristaltic movements of the intestine and the absorption of the chyle by the lacteals were exhibited and closely examined. A model of the circulation, consisting of india-rubber tubes and pump, was used for demonstrating the nature of the pulse, the pressure (by means of manometers placed in connection) in the arteries and veins, and the effect of dilatation and contraction of the capillaries and of rate of pulsation on this pressure. Finally, the thorax was opened in a narcotised rabbit and the heart exposed, and each student satisfactorily witnessed the pulsations of that organ and the inhibitory effect of irritation of the vagus nerve; the blood-pressure was exhibited to each member of the class in a similarly narcotised dog by means of the hæmodynamometer, a tube being placed in the animal's carotid artery; and as a concluding demonstration the important fact of the influence of nerves upon gland secretion was demonstrated by the beautiful experiment of Bernard, the chorda-tympana being irritated, whilst a canula was

placed in the duct of the submaxillary gland. Great care was taken that none of the experiments exhibited to or performed by the members of the class should be open to the charge of cruelty, the animals used being either completely narcotised, or (as in the case of the frogs), having the cerebral portion of the nervous system destroyed in the proper manner.

Throughout the course the morning's lecture was made preparatory to or an extension of what was afterwards brought under actual observation. The concluding lecture was devoted to a retrospect of the work which had been gone through, and an exposition of the idea which had guided the scheme of study pursued, the object having been not to make botanists, nor zoologists, nor anatomists of the members of the class, but to give them a practical insight into the structures and activities of living things, in such a way as to enable them to observe for themselves the relations and connections of the various forms of life, and to follow from actual examples the characteristics and increasing complexity of different plans of structure.

The reports of work and lectures daily sent in by the members of the class were entirely satisfactory, and the spirit and enthusiasm displayed throughout proved how greatly the value of the course was appreciated. When it is remembered that with scarcely an exception, these teachers had hitherto never used the microscope, never dissected a single organ or organism for themselves, nor seen one properly dissected, the advantage gained by the experience they have now obtained, even if only a portion of what was condensed into six weeks' work remains with them, is something very considerable, for it is something of a *new kind*, a form of knowledge which they entirely failed to obtain before.

It is exceedingly interesting to find that no difficulty was experienced in going over all these matters in a class which was not confined to men alone, and most heartily do we hope to see in the future a larger proportion of women engaged in this and other branches of scientific study. Those who imagine that women have some innate incapacity, and assert that if admitted to classes now limited to men they would be unable to profit by them, or would hinder the progress of the class by the greater attention they would require in order to keep them to the level of male students, may take this fact to heart—one of the microscopes offered as a prize for the best work done, and the best record of the lectures

and the day's work, was adjudged simply upon the merits of her reports and work to the one lady among the thirty-nine students who formed the class. On the other hand, this fact will probably stimulate that unavowed feeling, akin to the trades-unions' hostility to competition, which is the cause of the arbitrary exclusion of half of the community from our greatest educational institutions. — E. R. L., *in Nature*.

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE VALLEY OF QUITO. — II.

BY PROF. JAMES ORTON.

REPTILES.

The herpetology of mountain regions is very limited, for the number of species diminishes rapidly as we ascend in altitude or latitude. The reptilian life of any district, however, is highly interesting, as it is more natural and well defined than that of other vertebrates, because reptiles have a limited range* and are less likely to be forced out of their original habitats or introduced by man. It has been supposed that in order of altitudinal range, lizards go highest, snakes next, and batrachians and chelonians last. There are no chelonians in the valley as far as we know: but we found frogs as high up as Antisana Hacienda, and no lizards there. Gibbon found no snakes at La Paz.

The only reptiles which we know to exist in the valley are as follows: *Batrachians — Atelopus longirostris* Cope (a new species found by the writer at Antisana Hacienda, thirteen thousand three hundred feet above the sea), *A. lævis* Günth., *Hylodes conspicillatus* Günth., *Bufo intermedius* Günth.; *Ophidians — Herpetodryas carinatus* Boie, *Streptophorus Drozii* D. B. An active little lizard (a Pleurodont) occurs in the warm, dry parts of the valley; but we failed to secure a specimen.

FISHES.

Considering the size of the Machangara and Pastassa Rivers

* A remarkable exception is presented by our common Snapping-Turtle, *Chelydra serpentina* Linn., which we found at Guayaquil on the Pacific coast, 2° below the equator.

and San Pablo Lake, it is remarkable that only one species of this class (so far as we can ascertain) occurs in the Quito waters. This is the *Cyclopium Humboldtii* Sw., one of the Siluridæ. It abounds in the Machangara, but we have never seen a specimen over four inches long. According to Dr. Gill it is generically distinct from the *Stygogenes Humboldtii* of Günther; but we cannot distinguish it from the *Pimelodus cyclopum* mentioned by Humboldt* as in-

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*NOTE ON THE PIMELODUS CYCLOPUM OF HUMBOLDT. By F. W. Putnam.

Professor James Orton, in 1870, presented to the Academy a specimen of a small Silurid which he obtained at Quito, Ecuador, and which he supposed was the same as the fish mentioned by Humboldt from the subterranean waters of the Andes. On comparing the fish with the descriptions of the species of *Arges* and *Stygogenes*, given by Cuvier and Valenciennes, and by Günther in his Catalogue, I cannot see any reason for keeping the genera apart, as the specimen in hand unites the characters of the two. Agreeing in every detail with the short description given by Günther of *Arges brachycephalus*, with the additional character of having a short broad spine in front of the adipose dorsal, it has the serrations on the outer rays of the several fins which he mentions as characteristic of *S. Humboldtii*.

Our specimen has the following characters, which, it will be noticed, are taken almost word for word from the descriptions given by Günther of *A. brachycephalus* and *S. Humboldtii*. Head one-fifth of the total length of the fish. Eyes situated on top and about in the middle of the length of the head, very small, black. Nostrils are much nearer the extremity of the snout than to the eyes. Upper jaw slightly projecting. Lips thick, under lip, or labial fold, emarginate behind. Teeth in three or four rows, more or less notched; those on under jaw a little the broadest and with slightly deeper notches. The outer rays, or spines, of first dorsal, pectorals, ventrals, anal and caudal fins slightly prolonged and provided throughout their length with small spines projecting backward. Adipose fin moderately long, low, and reaching to base of upper caudal ray, a short broad spine at its front base *buried in the skin*. This spine is hardly equal in length to one-eighth of the length of the head. Longest rays of pectoral and ventral about equal in length. Pectoral rays reaching a little beyond the base of the ventrals. Ventral ray filament reaches to anus. Ventrals situated about under origin of dorsal. Color of the specimen brownish with dark motlings. Lateral line distinctly marked by raised pores, and extending the whole length of the body. Maxillary barbles about one-half the length of the head. Anal and dorsal fins fold into slight grooves.

Fin formula of

	D.	A.	C.	P.	V.	
Academy specimen,	I+7, I.	1+5.	I+5+6+I=13.	I+8.	I+5.	
A. brachycephalus,	I+6, 0.	6.	. . . . .	I+9.	6.	Günther.
S. Humboldtii.	6, I.	6.	13.	8.	6.	"

This slight variation in the fin rays would give the following for the three specimens. 1st dorsal, 6 to 8. 2d dorsal, 0 to 1. Anal, 6. Caudal, 13. Pectoral, 8 to 10. Ventral, 6; or allowing for a variation of two rays in the first dorsal and pectoral fins (which might very easily be an error in counting) we have the difference in the fin formula of the three specimens reduced to the presence or absence of the spine of the adipose dorsal, which could very easily be overlooked unless special search was made for it, as in the specimen under examination, in which it was found covered by the skin of the fin.

Under these considerations I can but think it probable that Humboldt overlooked the spine in his specimen, and also that it is possible that Günther overlooked it in his specimens of *A. brachycephalus*. At all events I cannot regard its presence as of any generic or even specific value on the present data.

habiting the subterranean waters of the Andes and thrown out in the eruptions of Imbabura and Caraguairazo. There are several species of the same family in the Esmeraldas, as *P. cinerascens*, *P. elongatus* and *P. modestus*.

MOLLUSCS.

There is little variety of molluscan life on the Andes. The land-snails predominate, belonging to the *Helicidæ* and *Cyclostomidæ*. The presence of the old world genus Clausilia, wanting in North America, becomes a significant fact, as Woodward observes, when taken in connection with the affinities of the higher animals of South America and Africa. "These imply a land-way across the Atlantic at some very remote period."

The known fresh-water shells in the valley are few in number, and the exact localities of these cannot be positively given. *Castalia Crosseana* Hid., and *C. Pazi* Hid., are credited to Imbabura; *Hemisinus Pazi* Tryon, *H. simplex* Tryon, *H. Osculati* Villa, *Ampullaria modesta* V. d. Busch and *A. solida* V. d. Busch to Quito; and *A. Quitensis* V. d. Busch to Ecuador. But Mr. Tryon informs me that the locality of Hemisinus is not certain; and as I collected none myself, I am doubtful of all the others except Castalia. *Hemisinus Binneyi* Tryon, may be added to this provisional list.

The type of the genus Arges (*A. sabalo* C. and V.), from the position of the eyes and ventral fins, may possibly remain as the type of a genus under that name, distinct from Günther's genus Stygogenes, which I consider as covering my specimen as identical with his *S. Humboldtii* and *A. brachycephalus*, which I consider the same as Humboldt's *Pimelodus cyclopum*. As Cuvier and Valenciennes had this last as a species of their genus Arges, and as Günther includes it (doubtfully) as a distinct species in his genus Stygogenes, and as Swainson also named it *Cyclopium Humboldtii*, we have a singular confusion of names, which, following the strict law of priority of names given, should be rendered thus:—

CYCLOPIUM (SW.) CYCLOPUM (Humb.)

Synonyms.

1. *Pimelodus cyclopum* Humboldt, 1803.
2. *Cyclopium Humboldtii* Swainson, 1838–9.
3. *Arges cyclopum* Cuv. and Val., 1840.
4. *Arges brachycephalus* Günther, 1859.
5. *Stygogenes Humboldtii* Günther, 1864.
6. *Stygogenes cyclopum* Günther, 1864.

Of these six names given as synonyms, Nos. 1, 2, 3 and 6 were unquestionably proposed for the same fish, and No. 5 was separated from them wholly because Humboldt did not mention the spine of the 2d dorsal. No. 4 was considered as distinct, and placed in a separate genus on account of the spine not being present. The specimen now under examination has a spine, and with it all the characters given of the species, hence I unite them all as one under the terribly non-euphonic designation of *Cyclopium cyclopum*, adding one more name to the list, which will be adopted, or classed as a synonym, according to individual views, but which, nevertheless, is the name that should be used to designate the species if the strict law of priority is followed.

The following *Notes on the Terrestrial Mollusca of the Valley of Quito, with a Catalogue of the species*, have been contributed by the eminent conchologist, Mr. Thomas Bland.

Looking at the subjoined catalogue * of the Terrestrial Mollusca attributed to, or which are known to inhabit, the valley of Quito,

* The following catalogue has been compiled from the various works to which I have had access. The genera and species are arranged in the order given by Pfeiffer in his Monographs, and the figures refer to the sections into which he divides the species. The subgeneric names of *Bulimus* in small capitals and of others in italics are from the last edition of Albers by v. Martens. The species, the names of which are in italics have been described since the publication of the latest editions of Pfeiffer's Monographs: –

Helix Quitensis Pfr. — Quito. (*Hyalina.*) § 11.
" Flora Pfr.—Quito. (*Ammonoceros.*) §35.
" Æquatoriana Hid.— Ecuador, Paz. §102.
" cymatodes Pfr. — Quito, Pfeiffer; Napo, Martinez. (*Isomeria.*)
" æquatoria Pfr. — Ecuador, Fraser.
" Juno Pfr. — Quito, v. Martens and Orton; Baeza, Martinez. (*Isomeria.*)
" Bourcieri Pfr. — Otovalo, Bourcier; Nanegal, Martinez and Orton, (*Isomeria.*)
" claromphalos Dev. et Hupe.— Quito, Paz; Cuzco, Hupe. § 113.
" Martinii Bern.—Quito, Bernardi. (*Isomeria.*) §118.
" bituberculata Pfr. — Quito, Paz and Martinez; Tunguragua, Bourcier. (*Isomeria.*)
" entodonta Pfr. — Cuenca, Fraser. §121.
" atrata Pfr. — Quito, v. Martens and Orton; Puntophaya, Bourcier; Macas and Napo, Martinez; Marmato, N. Granada, Bland. § 123.
" Hartwegi Pfr.—El Catamaija near Loja, Hartweg. (*Isomeria.*)
" *Ortoni* Crosse. — Between Quito and Napo? Orton.

Bulimus Phœbus Pfr. — Ecuador, Pfeiffer. §3.
" Popelairianus Nyst. — Quito, Isern; Bodegas, Paz; Napo, Martinez, and Orton. (BORUS.) §6.
" irroratus Rv. — Quito, v. Martens and Orton; La Mocha and Guaranda, Paz; Macas and Nanegal, Martinez; New Granada, Pfeiffer. (DRYPTUS.)
" Fungairinoi Hid. — Quito, Hidalgo and Orton; Cuenca, Paz and Martinez.
" *Corydon* Crosse. — Quito, Paz.
" *Aristæus* Crosse. — Quito, Paz and Orton.
" integer Pfr. — Quito, Ida Pfeiffer. (DRYPTUS.) §8.
" Fraseri Pfr.—Cuenca, Fraser; Chimborazo, Paz.
" abscissus Pfr.—Quito, Pfeiffer. §9.
" Bourcieri Pfr.—Pichincha, Bourcier. (*Thaumastus.*)
" coloratus Nyst.—Near Quito, Lattre; Prov. Cumana, Columbia, Nyst. (DRYPTUS). § 10.
" cardinalis, Pfr. — Quito, Pfeiffer and Paz; Quito and Nanegal, Orton; Napo, Martinez. (EURYTUS.)
" Membrillanus Crosse.—Ecuador, Paz and Hidalgo; Napo, Martinez. §18.
" lautus Gould.—Near Quito, Couthouy. §37.
" Nystianus Pfr. — Quito, Martinez; Machache, Paz; Valley of Pomasqui, Bourcier. (*Thaumastus.*)
" decoratus Lea. — Near Quito, Paz; Chimborazo, Pfeiffer; Carthagena, Lea. (*Drymaeus.*)

Bulimus fallax Pfr. — Tunguragua, Bourcier; Quito, Paz and Martinez. (*Thaumastus.*)
" Hartwegi Pfr. — El Catamaija near Loja, Hartweg; Quito and Cuenca, Paz and Orton. (*Thaumastus.*) §39.
" Thompsoni Pfr. — Near Quito, Pfeiffer and Orton; Machache and Cuenca, Paz. (ORPHNUS.)
" Taylorianus Rv. — Quito and Chimborazo, Bourcier; Quito, Paz and Orton. (EURYTUS.) §40.
" haplostylus Pfr. — El Catamaija near Loja, Hartweg. § 44.
" Cuencanus Pfr. — Cuenca, Fraser.
" Antisanensis Pfr. — Antisana, 14000 ft., Bourcier. (*Scutalus*) § 48.
" caliginosus, Rv. — Tunguragua and Chimborazo, Bourcier; Chimborazo, Paz. (*Scutalus.*) §49.
" subfasciatus Pfr. — Antisana, Bourcier.
" ambustus, Rv.—Tacunga and Ambato, Bourcier; La Mocha, Paz; Alchipichi, Martinez. (*Thaumastus.*)
" Quitensis Pfr. — Quito, Delattre; Ibarra and Otovalo, Martinez. §51.
" irregularis Pfr.—Near Quito, Lattre, Ibarra, Otovalo and Pillaro, Martinez.
" Cotopaxiensis Pfr. — Cotopaxi, Pfeiffer; Antisana and Pichincha, Martinez; La Mocha and Chimborazo, Paz; var. B. Cayembe, Bourcier. (*Scutalus.*) § 54.
" Loxensis Pfr. — El Catamaija near Loja, Hartweg. (*Thaumastus.*) §56.
" chamæleon Pfr. — Quito, Bourcier; La Mocha, Paz; Cumbaya, Baeza and Nanegal, Martinez; Peru, Almagro. (*Thaumastus.*)
" æquatorius Pfr. — Sincholagua and Chimborazo, Bourcier; Quito, Paz, Orton and Martinez; La Mocha, Paz. *Scutalus.*) §57.
" Catlowiæ Pfr. — Near Quito, Bourcier; Ambato, Paz. (*Scutalus.*)
" Limensis Rv. — Near Lima and Quito, Pfeiffer.

Orthalicus Mars Pfr —Ecuador, Fraser. § 5.
Achatina magnifica Pfr.—Near Quito, Delattre. §1.
Oleacina saccata Pfr.—Ecuador, Fraser. § 6.
Clausilia Bourcieri Pfr.— Tunguragua, Bourcier, (*Xenia*) §3.
Cyclotus Quitensis Pfr.—Quito, Paz and Orton; Napo, Martinez; New Granada, Bland. § 1.
" Dunkeri Pfr. — Riobamba, Pfeiffer; New Granada and Venezuela.
" Popayanus Lea.—Chimborazo, Linden; New Granada, Bland.
" granulatus Pfr.—Quito, Paz.
" *Fischeri* Hid. — Quito, Paz; Aguarico, Martinez.

it does not appear that any considerable number of the species have passed beyond its limits. The most interesting question respecting their distribution, is to ascertain if any occur both on the Pacific and Atlantic slopes of the Equatorial Andes, and so far as I am informed there are scarcely any. While several of the valley species are found also to the south in Peru, and a larger number to the north in New Granada, others are common to the valley and the eastern slope towards the headwaters of the Amazon.

The species mentioned in the catalogue, which from the habitats given appear to occur on the Pacific and Atlantic slopes, are *Bulimulus chamæleon* Pfr. referred to Nanegal on the former and Baeza on the latter, *Bulimus irroratus* Rv. from Guaranda and Macas, and *B. Popelairianus* Nyst. from Bodegas and Napo. Further exploration may increase the species known thus to occur, but the difference in the land-shell faunas on the Pacific and Atlantic slopes on the west coast of North America, warrants the belief that such species are few.

The absence in the Quito valley, and generally on the west coast of South America, of various New World genera is worthy of remark, but they belong to the faunas of Brazil, Mexico, and the West Indies, with which those of the west coast have a scarcely appreciable alliance.

In South America generally, and the valley of Quito is no exception, the genus Bulimus has far more representatives than Helix (using both generic terms in the wide sense employed by Pfeiffer in his monographs), but the reverse is the case in North America. In the Galapagos Islands there are a number of peculiar Bulimi, but I believe no Helices, while in the islands off the west coast of southern California species of Helix occur but none of Bulimus. On the Atlantic side of the Continents, the islands (Cuba, Jamaica etc,) situate on the northern margin of the Caribbean sea, with numerous species of Helix, have very few of Bulimulus, while the islands on the eastern side, near to the South American coast (St. Lucia and St. Vincent to Trinidad) have the only representatives of Bulimus in the West Indies and a larger proportionate number of species of Bulimulus.

Cyclotus *Pazi* Crosse.—Ambato, Paz.
Cyclophorus Cumingi Sow. — Quito, Paz. § 15.
" hæmatomma Pfr. — Quito, Paz.
" *Hidalgoi* Crosse.—Ecuador, Paz.
Cyclophorus *Crosseanus* Hid.—Ecuador, Paz.
Bourcieria helicinæformis Pfr. — Quito, Paz.; [Yaraqui Valley, Bourcier.
Bourcieria Fraseri Pfr. — Cuenca, Fraser.

The form of Helix prevailing in, and which may be said to be characteristic of the Quito Valley is Isomeria, peculiar to the northern portion of the southern continent. Both Bulimus and Bulimulus are essentially characteristic of South America.

The genus Orthalicus is also South American, but belongs rather to the eastern than to the western side of the continent. *Achatina magnifica*, as Pfeiffer suggests, is probably an Orthalicus. Oleacina is most numerously represented in Mexico and Central America, and the nearest adjacent islands of the West Indies. One species is said to inhabit Ecuador, but the exact locality is not given.

Clausilia is a European genus, but has representatives in Asia, and a few species of the sub-genus Nenia in South America,—one only in the West Indies, *C. tridens* Chem. of Porto Rico. Species of three operculated genera occur in the Quito Valley,—Cyclotus, Cyclophorus and Bourciera. The latter, peculiar to Ecuador, is placed by Pfeiffer, in the sub-family Realia of the family Cyclostomacea, but it would seem to belong to Helicinacea, with which, as pointed out by Troschel, its dentition agrees, although in form of shell it is allied to Realia. Cyclotus has several species in Mexico and Central America, more in South America, but forty-two species in the West Indies, of which thirty-four belong to Jamaica. It may be mentioned that half of the species attributed to the valley of Quito, occur also in New Granada.

Cyclophorus has its principal development in Asia and adjacent islands, but it is curious, as I have elsewhere noticed, that while there are a few species found in Mexico, Central and South America, seven occur in the West Indies, and all in Guadeloupe, Dominica and Martinique.

NOTES ON THE GEODES OF ILLINOIS.

BY PROF. GEORGE H. PERKINS.

Not least interesting among the many localities in the Mississippi valley that attract the geologist and mineralogist is the Illinois Geode region. This extends for twenty-five or thirty miles

along the Illinois side of the Mississippi, reaching from a short distance above Niota on the northern border of Hancock County southward beyond Warsaw; and indeed the formation in which these specimens occur reaches as far south as the mouth of the Illinois River, but by far the greater part that have been collected were obtained between Niota and Warsaw, where they occur in very much the greatest abundance. Very many fine specimens have been obtained across the river in Iowa, and the region over which they are distributed is probably larger in this state than in Illinois. So far as my own observation goes, the geodes do not occur in Illinois at any great distance from the river, nearly all the best localities being within three or four miles from the banks; but I do not speak with entire confidence in regard to this as nearly all my personal investigation has been confined to localities near the river and on the Illinois side. For this reason what may be said at this time will refer mainly to the region between Niota and Warsaw. The geodes from this region are, many of them, very beautiful, being often lined with most brilliant crystals of quartz, appearing like miniature caves lined with diamonds, or, less brilliant but more exquisite, some are lined with a frost-work of small white crystals of the same substance, or with satin crystals of calcite and pearl spar. They are imbedded in a soft, brittle, argillaceous shale, which is sometimes a little calcareous, and in a very few instances passes into limestone, although the outer coating of the geode is always aluminous. This mass of shaly rock forms what is called the "Geode bed," a member of the Keokuk group of the Subcarboniferous age. The thickness of this bed varies in different places, but is nowhere very great. At Warsaw it is well exposed in a railroad cut, and here, according to Mr. Worthen, the thickness is forty feet. (Ill. Geol. Rep., Vol. 1. p. 335.) No trace of fossils has been discovered in the shale, but in some places thin layers of limestone are intermingled with it, and these afford the characteristic fossils of the Keokuk limestone. Whatever the inner coating of these geodes may be, the shell, or crust, is always siliceous. The outer surface, however, is usually coated with the same clay-like material as that which composes the shale in which they occur. Very often there is an outer layer of siliceous clay which forms a part of the crust and sends out numerous sharp, irregular projections into the next layer which is, probably always, chalcedony. It should be remembered that these,

and other not yet mentioned "layers" of the crust are so called more for convenience, than because they exist sharply defined in every specimen, for such is not the case; in most they shade into each other by almost imperceptible degrees. The outer surface is generally light colored — either yellow, or drab, or yellowish brown; but when there is much oxide of iron present the color deepens to chestnut brown. The general form of the geodes is more or less spherical and in a majority of the specimens it is quite regularly so, but the character of the interior seems to have some influence in shaping the whole mass. In my own collecting, at least, it has uniformly been true that those geodes that contained only quartz were most regular in form and those lined with crystallized quartz are rather more regular than those lined with chalcedony. Those specimens that contain oxide of iron are often quite flat, as are those with calcite, though these latter are usually flattened more on one side than on the other and in various ways made irregular.

Although sometimes packed almost as thickly as possible in the shale, the geodes are for the most part entirely distinct from each other; but sometimes two or more are found adhering to each other, either two of nearly equal size forming a dumb-bell shaped mass, or, more commonly, a large one is surrounded by several much smaller. These are not often so firmly attached that a sharp blow will not separate them entire. When broken these smaller geodes are usually solid. Sometimes small, pocket-like geodes are found in the crust of large and heavy ones, and sometimes these extend so far over the surface that the geode becomes like a ball coated outside and in with crystals, with occasionally a thin clayey crust over a part of the outside.

The geodes are not exactly alike in different portions of the region. In some places nearly all are small, while large ones are not infrequent in others, in one place most are regular spheres, in another most are quite irregular, in some parts of the bed they lie so thickly as to crowd each other, in other parts they are far apart. Not only do these and similar differences occur in places at some distance from each other, but in the same place upper, lower or middle portions of the bed may differ widely in the number, form, size and contents of the geodes. Everywhere many of the geodes are solid, and the first thing for a collector to learn is to judge by the weight of any given specimen whether it

is solid or hollow, and also how hard a blow is needed to break it open, if he finds it light enough to be hollow; for a heavy blow, such as is necessary to crack a thick crust, would dash a thinner one into small fragments. Those large geodes that contain much calc spar are usually solid, while those that are smaller and lined with small crystals of this material are frequently quite hollow. The quite large specimens are more apt to have thick walls, or to be entirely solid, than those of less size whatever the filling. The cavity of a geode does not often correspond with the exterior, as the walls are constantly varying their thickness. Many are lined with a single, plain layer of crystals, others have this crystalline surface raised in rounded prominences, some of them long and cylindrical, others low and mound-like. In some, besides the lining there is a partition, extending across the cavity, lined with crystals on both sides. Rarely, the collector may find a thin crust lined with small bright crystals, within which is a hollow ball, but little larger than the cavity and attached at one or two points to the side, covered with somewhat smaller crystals. So, in innumerable ways do we find these singular objects varied and, as the outside gives little or no indication of the inside, the charm of uncertainty is added to the excitement and pleasure of the collector. So far as my own experience goes those specimens that are from one to three inches in diameter are least likely to be solid, though very fine ones may be obtained six or even ten inches in diameter without great difficulty. The range in size is quite large, as very pretty specimens not over half an inch in diameter may be found, while the largest I have seen were fully eighteen inches across the broken halves. But these larger geodes, aside from being very scarce, are not very desirable acquisitions as they are very heavy, weighing fifty pounds or more in the best examples. The geodes are most abundant, and hence most easily collected, in the beds and along the sides of those streams which intersect the geode bed, as nearly all those around Hamilton and Warsaw do. The geodes are dislodged from their resting place by high water, frost, etc., and are carried down by the streams, so that near the mouth, or in a basin, the ground is often paved with them, but good specimens are not rare along the sides of the streets, in cuts, or wherever the earth has been washed or dug in the neighborhood of the bed in which they lie. Few things are more unpromising or unattractive than a geode when first taken

from its cavity in the rock, and unless its regular form caught the eye, it would be passed without a second glance as wholly undeserving of notice. A mere ball of clay would possess fully as much elegance. But pick up that dull, dirty-looking ball, and, if it be a good specimen, its extreme lightness attracts attention and excites curiosity, and now the impulse is to see what there is inside. A few strokes of the hammer and it breaks in halves, and as it falls apart lo! what wonders are presented to us! Who would have imagined that so uncouth and rough an exterior concealed such a splendid interior,—a crystal grotto, which flashes and sparkles when the sunlight strikes it as if made of gems of the first water. The geodes contain quite a number of different minerals which are very variously arranged in different specimens.

Some of these minerals have been already alluded to, but they deserve a somewhat fuller treatment. As all the geodes are siliceous on the outside, so by far the most common variety is that composed wholly, or nearly so, of quartz. The structure of these is almost invariably as follows; first, the outer, earthy coating; second, a thin layer of white or whitish chalcedony; third, a layer of clear quartz more or less granulated; and fourth, a layer of crystalline quartz, with simple, pyramidal terminations lining the inside. The granular layer does not always extend around the entire sphere, but often the crystalline quartz rests directly on the chalcedony, and in some there is scarcely any or no granulated appearance, but it is present in most that have come under my notice. The crystals of the inner layer are usually clear and colorless, but many times they will be tinged a more or less deep yellow by oxide of iron, and a few crystals have been found lying detached in the cavity of the geode, so bright a yellow as to cause them to resemble the topaz very closely, and some have been cut and sold as topazes. Not infrequently the crystals have a slight bluish tinge which, instead of the brilliant white lustre, gives them a soft and liquid hue, as if just ready to melt into purest water. Crystals of smoky quartz are occasionally found, and I once had the good fortune to break a rather clumsy specimen about three inches by four inches in size, the inner coating of which was rose quartz. Instead of a simple layer of crystals, either plain or variously convoluted, specimens are not uncommon in which the crystals, many of them doubly terminated, are piled upon each other in all directions, and sometimes these clusters are

loose in the cavity, or the latter may be filled with single crystals, often so small as to appear like fine sand. The crystals are not always clear, but may be covered with a layer of chalcedony sometimes so thin as not to modify the form of the terminations, sometimes thick enough to make a papillose surface. This coating may be either light blue, flesh color, yellowish white, or a bluish opal-white, all of them appearing semi-transparent or of an opaque, chalk white. Many of this last color have the crystalline terminations so modified as to appear cubical. In a few very beautiful specimens that I have seen, a clear white chalcedonic surface was sprinkled all over with small, perfectly colorless crystals, looking like fine dew drops on a white flower. This coating becomes thicker and thicker, until all trace of the crystals is lost, and then we have a layer of chalcedony with a perfectly smooth botryoidal or mamillary surface, outside of which is a layer of crystalline quartz, then, usually, a granulated layer and then the outer chalcedony layer. The inner layer is sometimes very thick, being twice the thickness of all the rest.

The color of the chalcedony is most often a reddish purple, but not very seldom we find a greenish yellow or bluish white and rarely a chalk white. In rare cases there are two layers of different color, such as pure white over dark brownish purple. In a few cases the surface of the chalcedony is sprinkled with crystals of pyrites or other substances, but yet the geodes afford a marked contrast in this respect to those lined with crystalline quartz, for while the former are remarkably free from what might be termed foreign substances and never, so far as I have seen, is any considerable part of the cavity filled with them, in the latter variety we find, resting upon the quartz, all the different minerals found in the geodes, and often two or three together nearly filling the cavity. Besides the isolated crystals of calcite and dolomite found resting on the quartz crystals, we have some in which the lining is made up entirely of one or the other of these substances. Like all the rest these are siliceous on the outside. In the calcite geodes the crystals are usually small and of rhombohedral form, which is often obscured by their crowding together or piling upon each other. In color they differ, some being colorless and transparent, many white, or yellowish, or flesh color, and some few dark purple or chestnut brown, and in one case a layer of dark brown crystals was ornamented with here and there a cluster of pure white ones. Two or more forms of crystallization may occur

one upon the other in the same specimen, as, for example, a scalenohedral crystal resting upon differently modified rhombohedrons. Sometimes the cavity of the geode is filled with a mass of white or, rarely, flesh colored calcite. Isolated crystals, or groups of crystals of pearl spar or dolomite, are of quite common occurrence both in the quartz and calcite geodes, but a complete layer of this mineral is less common. The crystals are generally quite large as compared with the size of the geode.

According to Prof. Brush (Ill. Geol. Rep., Vol. 1, p. 91), this dolomite contains "a large per cent. of carbonate of iron with the carbonates of lime and magnesia." Although the usual color of the dolomite is either a light yellowish brown or silvery gray of different shades, it is often stained a rusty brown by oxide of iron.

The collector will once in a while meet with a geode, probably of quite small size, filled with a fine white powder. Prof. Brush states this to be a "hydrous silicate of alumina." The only metals thus far found in the geodes are iron and zinc. The iron occurs in the form of oxide, in small crystals and in powder; one geode about one and a half inches in diameter lined with small quartz crystals was filled with the powdered oxide. Besides this, long, slender, hair-like crystals of pyrites occur as well as those of cubical form. These are scattered over chalcedony, quartz crystals and calcite, and are also imbedded in the calcite. Zinc blende is quite common occurring either in crystals, some of them quite highly polished, or in a mass in the centre of solid geodes when it is associated with calcite.

In the northern part of Hancock county a few geodes, all that I have seen being lined with quartz crystals, contain asphaltum. Prof. Brush describes one of these as "apparently more than half filled with asphaltum, breaking with a clear conchoidal fracture, having a high lustre and jet black color and containing imbedded in it detached crystals of quartz" (Ill. Geol. Rep., Vol. 1, p. 92). This was four by three inches in size. Instead of asphaltum some are filled with petroleum. Besides those minerals enumerated, Prof. Brush reports finding in a very few cases minute crystals of gypsum and in one of arragonite. Water is found in some of the geodes which is bitterish to the taste, and contains, according to Prof. Brush, a small per cent. of the sulphates of lime and magnesia and a slight trace of silica. As the crust of the geodes is wholly impervious to water, this must have been inclosed when the crust was formed. As Mr. Worthen remarks

it is worthy of notice that, while the geodes are always surrounded by material rich in alumina, no crystallized forms of this mineral have yet been discovered in them. Geodes of fine quality occur in Missouri, and Prof. White reports calcareous geodes, some of them entirely free from silica, in a soft magnesian lime-stone, in North Eastern Iowa.

Any one who for the first time sees a fine geode and notes its regular form, its uncouth exterior and brilliant interior is sure to ask "How was it made?" The more specimens he sees the more is his curiosity excited, and if he visits the locality and sees them *in situ* his wonder and interest increase to the highest pitch. There are very many difficulties to be overcome in trying to account for the presence of the geodes and their formation, and it may be only presumption to attempt that which so many skilful mineralogists have passed in silence. However, a careful study of the geodes, both in cabinets and in their native bed, has convinced me that they must have been formed in some such manner as that here presented. What now constitutes the geode bed, was at one time a mass of plastic clay filled with siliceous and calcareous fluids. That it was plastic is shown by facts obvious to any one who has ever visited the locality. If now this mass were acted upon by steam or some other vapor, or gas, as dough is acted upon by carbonic acid, it would like the dough be filled with cavities of all sizes of a more or less spherical form, and irregularly distributed through the mass. Into these cavities the solutions of silica etc. would filter and in some cases crystallize, in others simply deposit the solids held in solution, according to circumstances. The form, arrangement, etc., of the various substances would be determined, I suppose, by their densities and the laws of crystallization. After all the materials had hardened, the soft brittle clay would easily separate from the harder filling of the cavities and this would then fall out shaped by the mould in which formed.

REVIEWS.

The Peabody Museum of American Archæology and Ethnology.*—The fourth annual Report contains much that is of gen-

* Fourth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. Boston, 1871. 8vo. p. 27.

eral interest. Professor Wyman, the curator, gives some exceedingly valuable "Observations on Crania and the parts of the Skeleton," with comparative measurements of the fifty-six skulls from Peru, presented by Mr. Squier, together with thirty-eight from the mounds of Kentucky, obtained by Mr. Lyon, and eighteen from the mounds of Florida collected by the curator. He remarks that: —

"The average capacity of the fifty-six Peruvian crania measured agrees very closely with that indicated by Morton and Meigs, viz., 1230 c.c., or 75 cub. inches, which is considerably less than that of the barbarous tribes of America, and almost exactly that of the Australians and Hottentots as given by Morton and Meigs, and smaller than that derived from a larger number of measurements by Davis. Thus we have, in this particular, a race which has established a complex civil and religious polity, and made great progress in the useful and fine arts, as its pottery, textile fabrics, wrought metals, highways and aqueducts, colossal architectural structures and court of almost imperial splendor prove, on the same level as regards the quantity of brain, with a race whose social and religious conditions are among the most degraded exhibited by the human race.

All this goes to show and cannot be too much insisted upon, that the relative capacity of the skull is to be considered merely as an anatomical and not as a physiological characteristic, and unless the quality of the brain can be represented at the same time as the quantity, brain measurement cannot be assumed as an indication of the intellectual position of races any more than of individuals. From such results the question is very naturally forced upon us whether comparisons, based upon cranial measurements of capacity as generally made, are entitled to the value usually assigned them. Confined within narrower limits they may perhaps be of more importance. But even in this case the results are often contradictory. If the brains of Cuvier and Schiller were of the maximum size, so were those of three unknown individuals from the common cemeteries of Paris — while that of Dante was but slightly above the mean, and Byron's was probably even below it."

He also refers to the singular perforations of the humerus, which seems to occur in white, Indian and black races, but more commonly in the blacks; it is also quite general though not constant in the apes.

The flattening of the tibia has been noticed in the reindeer period in Europe, and Professor Wyman finds that it prevails largely, but in a variable degree in our Indians. In regard to the

bearings of these facts on the relations of man to the apes we quote as follows: —

"From a comparison of the skeleton of the human races, as far as made, it is quite clear that in several respects some of them have peculiarities which seem to assimulate them to the apes. These peculiarities are not, however, confined to a single race, but are distributed in different degrees through several, and it is not improbable that future studies will show a still greater variety of resemblances, and a wider distribution of them, than is now known. The increased length of the forearm, as compared with the humerus, is almost equally shared by the blacks and the recent Indians. The Indians, from the mounds of various parts of the country, as well as the inhabitants of the ancient cave dwellings of Europe, have the flattened tibia. The Indians, ancient as well as modern, in common with the Hawaiian Islanders, have the most backward position of the foramen magnum, while the Negro, on the other hand, with his lengthened forearm, has this foramen almost as central as in the white man. The small brain is not, as might at first well be supposed to be the case, found in the most degraded races alone, but in these, in common with a race which had, as already stated, risen to a semi-civilization; nor is it constantly associated with the lengthened forearm, since in the Australians this is even shorter than in the white man. From these results it seems obvious that we cannot give to the alleged resemblances between the human races and the apes their full meaning, until we have much wider comparisons than have as yet been made."

The Position of the Caddis Flies.* — This paper, containing detailed descriptions with excellent illustrations, may be regarded, as the author remarks, as the continuation of several memoirs on exotic Trichoptera published in the "Transactions" of the Entomological Society of London. Quite a number of the species are from California, one is from the White Mountains, another from Newfoundland, another from New York, while the remainder are from other parts of the world. The descriptions of genera and species are elaborated with the author's usual care and thoroughness, and great attention is paid to the illustration of details of structure, which gives the paper a lasting value.

We are also indebted to the author for his views on the systematic position of the Trichoptera, and for a very courteous criti-

*On new Forms, etc., of Extra-European Trichopterous Insects. By Robert McLachlan. Extracted from the Linnæan Society's Journal.—Zoology. Vol. xi. London. 1871. 8vo. pp. 43, with 3 plates.

cism of the positions taken by the reviewer as to the classification of the Neuroptera. We will first quote the opinions of this able and experienced observer, and show wherein and why we differ from his conclusions:—

"But it is necessary, first of all, just to glance at the position generally accorded to the *Neuroptera*. It has long been seen that the order as defined by Linné, is composed of most incongruous materials; and Erichson attempted an amelioration of this condition by grafting all those families with incomplete metamorphosis upon the *Orthoptera*, still maintaining the two orders in juxtaposition. Since his time various authors have made this division, termed *pseudo-Neuroptera*, a veritable refuge for the destitute. To it have been added, from time to time, *Mallophaga*, *Thysanura*, *Thysanoptera*, and even the *Strepsiptera*, for no other reason, so far as I can see, than that they would not fit in satisfactorily elsewhere; and the characters of the order being so elastic, it was easy to find some peculiarities which gave these outlying families admission therein. That the Linnæan families grouped now with *Orthoptera* have more affinity thereto than to the *Neuroptera* as usually constituted, is evident; yet I see no reason whatever why the *Odonata* should not form an order apart, possessing as they do, characters absolutely *sui generis*. The admission of them into *Orthoptera* renders an already heterogeneous order an absolute chaos. For my part, I have been content to consider the *Neuroptera* as an order, in the Linnæan sense, divisible into three great divisions, *pseudo-Neuroptera*, *Planipenna*, *Trichoptera*,—but this only as matter of convenience; for I am convinced that contained therein are constituents of several orders, each of equal value with such as *Lepidoptera*, and *Coleoptera*, and that the day will arrive when, from an increase of knowledge in embryology and anatomy, the order *Neuroptera*, as constituted by Linné, will be scattered widely—a dismemberment that would have occurred long since, only that there still exists a lingering disinclination to thoroughly upset the Linnæan system.

Dr. Packard's arrangement is founded on the idea that in insects as in all other divisions of the animal kingdom, there are certain groups more elevated, others more "degraded" than the rest. Acting upon this, he places the *Hymenoptera* as structurally and psychically, if I may use the term, superior to all other insects. Then follow *Lepidoptera*, *Diptera*, *Coleoptera*, *Hemiptera*, *Orthoptera*, and last of all, the *Neuroptera*, in the Linnæan sense (but including *Thysanura*), an order which, according to him, "mimics every suborder of insects," being "comprehensive or synthetic types, combining the structure of all the other suborders". I would here particularly call attention to the relative positions occupied by *Lepidoptera* and *Trichoptera*, the latter forming nearly the last division of *Neuroptera*. I emphatically enter

my protest against such a wide separation of the two groups, considering, as I do, that, whatever may be the condition of the *Trichoptera* with regard to others of the Linnæan groups of *Neuroptera*, their relationship to the *Lepidoptera* is close, and that an attempt to thus widely separate them is an outrage on both. In metamorphosis the resemblance is nearly complete, the fact of the pupal limbs not being enclosed within a common integument not availing much when their condition in certain *Microlepidoptera* is taken into consideration: the possession of mandibles by the Trichopterous nymph is not of much importance, insomuch as these organs bear no relationship to the aborted mandibles of the imago; they simply replace the acid or mechanical means by which a Lepidopterous imago frees itself from its cocoon. The imago in *Lepidoptera* is almost constantly furnished with scales on the wings and body, scales of a peculiar nature, the analogues of which are seen only in *Lepisma*; but many Trichopterous insects have, in the male, a modification of these scales in the form of short inflated hairs, generally intermingled with ordinary hairs; and in some genera this tendency towards a scaly clothing is as marked as is its absence in some *Lepidoptera*. The neural arrangement is not at all incompatible with a close relationship; nor are the parts of the mouth, excepting the absence of a developed haustellum; yet many of the larger *Trichoptera* frequent flowers for the purpose of extracting the nectar; and though I am unable to say by what means this is effected, it seems probable that it is done by prolongation, at will, of the upper portion of the œsophagus into a sort of false haustellum. Perhaps the strongest mark of demarcation is the presence, in most Lepidopterous imagos, of a spine-like process near the base of the costa of the hind wings, wanting in all *Trichoptera*. That this process is a modification of a vein is almost certain; and I apprehend that, when the homologies of neuration are better understood, this negative character in *Trichoptera* will not be found of much importance. My own inclination tends strongly towards maintaining *Trichoptera* as a separate order in juxtaposition with *Lepidoptera*."

First: we fully agree with the author that the admission of the Odonata (Libellulidæ) into the Orthoptera "renders an already heterogeneous order an absolute chaos." But on the other hand, we think the burden of proof that the "Odonata" are not true Neuroptera rests on those who regard the group as an independent order. Where respectable authorities (taking it for granted that their characters are neither Neuropterous nor Orthopterous, which we do not admit), regard them as a division of Neuroptera, no one having, as far as we know, considered them as Orthoptera before Erichson's time; and others equally respectable regard them as

Orthopterous, or Pseudoneuropterous, we would abide by embryological data to decide the question. The embryology of the Libellulidæ is perhaps as thoroughly known as that of any other group of insects. During the past summer the writer has observed with considerable care the embryology of Chrysopa, a type of the "true" Neuroptera, in the restricted sense. In the earliest and later stages the development of this genus is almost identical with that of the dragon flies, as regards the structure and relations of the "ammion" and "visceral membrane," the relations of the primitive band, the early form of the embryo, and its position just previous to exclusion from the egg (see this journal, p. 564). The differences are merely such as we would expect to find between two families of the same order. Thus embryology gives us the most unexpected and independent testimony as to the close alliance at least of the Libellulidæ and Hemerobidæ. Should our conclusions stand the test of the observations and criticisms of abler naturalists, then have we not demonstrated the close relationship of these two divisions of (what we regard as) Neuroptera? We conceive the greatest gap in the Neuroptera (in the Linnæan sense) to be between these two families. The Libellulidæ, through the Ephemeridæ, their nearest allies, pass into the Perlidæ and Psocidæ; on the other hand, the Hemerobidæ are connected by many characters with the Panorpidæ, and to the latter, as we believe, the Phryganeidæ (Trichoptera) are more nearly related than any other group of insects, whether we take into consideration the structure of the adults, or the form of the larva and pupa, and their metamorphoses. The gap between the Libellulidæ and Hemerobidæ is indeed a wide one, but have we not seen that the foundations of the bridge have been laid in the embryonic stages, and may we not feel authorized in view of recent discoveries of paleozoic net-veined insects, in believing that the superstructure, the arches and timbers of the bridge, has been swept away by the storms and floods of past geologic ages? Evidence is accumulating and growing stronger each year, if we interpret the facts aright, that the gaps between what we consider the families of the Neuroptera are due to the extinction of genera and species in paleozoic and mesozoic times. So that instead of a "dismemberment" of the Neuroptera, we shall really have a more thoroughly compacted and natural group than as yet recognized by systematists.

Secondly, as to the relationship of the Trichoptera to the Lepidoptera. It seems to us that we each look upon this matter from a different standpoint. We would claim that the characters which Mr. McLachlan relies upon as allying the caddis flies to the moths are adaptive and of secondary importance. Let us leave them out of sight for the moment, and look at what the reviewer deems the more essential ones. Strip our examples of moths and caddis flies of their wings and legs up to the coxæ, removing the antennæ and palpi, and place the naked trunks side by side. We shall find a wonderful uniformity of structure in the head and body of the Lepidoptera, to which we have previously called attention.* We shall observe that the three portions of the lepidopterous head, the occiput, epicranium, and clypeus, always preserve much the same relation to each other. The front of the head is formed by the epicranium and clypeus, the latter usually being the larger of the two parts, though in the Tineids the two pieces are of nearly the same size. Looking at the thorax, another essential character of the Lepidoptera is the very short metathorax, and the absence of the præscutum. In one moth, the degraded Hepialus, the metathorax is much longer than in any other moth known to us, and the præscutum is well developed,† resembling the "true" Neuroptera in this respect. The head of the Phryganeidæ, though varying greatly in the different genera, differs invariably from that of the moths in the front of the head consisting of the clypeus alone enclosed in the broad orbits, while the broad vertex consists of the epicranium, which is as large as the entire front of the head; the head is wider and the eyes much smaller than in the moths; and another important character is the broad, deeply excavated front edge of the clypeus, this part in the moths being invariably narrower and much rounded.‡

The metathorax of the caddis flies is always much longer than in the moths, often twice as long, and the præscutum is nearly always well developed. These characters of the head and thorax

* Notes on the family Zygænidæ. Proc. Essex Institute. IV. 1864. p. 14.

† For further remarks and figures in illustration see our remarks "On Synthetic Types in Insects." Journal of the Boston Society of Natural History. viii. 1863.

‡ These remarks are based on careful observations of *Hallesus* sp, *Limnophilus despectus*, *Philopotamus* sp., and *Setodes exquisita*. From an examination of these portions of the body in these and other genera we would inquire whether neuropterists have not overlooked the source of most excellent and stable generic characters; those most in use, such as the venation and spurs varying in different sexes of the same species.

noticed in the caddis flies are just those characterizing the Neuroptera. If we place our trunk of a caddis fly by the side of that of any one of the Hemerobidæ we shall find a much greater similarity to this family than the moths. So far as we are aware neuropterists have never paid sufficient attention to the parts of the trunk to which we have referred, just as lepidopterists have uniformly overlooked the characters noticed above, and which are of the first importance in establishing families.*

As to the less essential characters, called secondary or adaptive by naturalists, we have gone as far as any one† in noticing their remarkable analogy to those of the Lepidoptera. But we should not feel authorized on this account to remove the caddis flies from the Neuroptera, and place them in an independent group next to the Lepidoptera. On the same principle we might remove the Psocidæ and place them in an independent order next the Aphidæ; or remove the tailed Batrachians and place them among the lizards.

Turning to the larvæ, we find that their most essential characters ally them to the aquatic Hemerobidæ and Sialidæ, the larvæ of some genera closely resembling in their essential characters that of Corydalus; in the pupa, the limbs are as free as in those of the two neuropterous families Hemerobidæ and Sialidæ. While in the majority of lepidopterous pupæ the limbs are soldered to the body, yet where they are partially free, as in some Tineidæ, the form of the lepidopterous pupa is throughout adhered to more strictly than would be inferred from Mr. McLachlan's statement.

Our author says that the mandibles of the pupa "bear no relationship to the aborted mandibles of the imago." May we ask with what organs he homologizes the mandibles of the Phryganeid pupa, if not with those of the larva and adult?

Taking up the points of resemblance to the Lepidoptera, brought forward by our author, we would agree with him that they are for the most part very remarkable and suggestive, but would suggest that they are not of much value when used as ordinal characters. He does not seem to notice the fact that insects of other groups than the Lepidoptera and Trichoptera have scales on their bodies. We would go farther than him and say that the scales of Lepisma and we would add of all the Thysanura (except in a few scaleless genera) are truly homologous, rather than "analogous" with those

*See remarks in "Notes on the family Zygænidæ."
†Synthetic Types, etc.

of the Lepidoptera. Certain Diptera, such as the Culicidæ, have scales mingled with the hairs on their bodies, as many years ago shown by Mr. Jabez Hogg, and more recently by Müller; the species of Amphientomum of the family Psocidæ, as he is undoubtedly well aware, have scaly bodies; so that this character is by no means peculiar to the two groups mentioned by our author. Did the Trichoptera possess the hook and bristle in the wings of the Lepidoptera (a most inconstant character even in the moths) why should such a trivial character be considered as of any importance in ranking ordinal (or subordinal) groups?

Our own view, judging not only from the structure of the adults, but also of the larvæ and pupæ, is that the Lepidoptera rank next above the Diptera, the Tineids and Pterophoridæ having many points of agreement with the Culicidæ and Tipulidæ, which seem to us to be as deeply seated as the resemblance to the Phryganeidæ. In an evolutional point of view we have been accustomed to regard the moths as having perhaps sprung from these dipterous families. Hence we have been unable to agree with the opinion of E. Müller (see this journal, vol. v, p. 288) that the Lepidoptera have sprung from the Phryganeids, though we can easily see that many will be convinced by his statements. But he has, we venture to think, erred in the same way as our author, in overlooking the fundamental characters of the Phryganeidæ, and regarding the adaptive, superficial characters, drawn mostly from the appendages, as of primary value.

Supplement to the Catalogue of Ophiuridæ of the Cambridge Museum.*—This paper is particularly interesting from the excellent figures illustrating the most important species dredged at great depths between Cuba and the Florida Reef. The note on nomenclature and classification deserves mention in connection with the article on this subject by Mr. Alex. Agassiz, published on p. 354 of the present volume of this journal. As to the matter of changing the *authority* with each change in the *combination* of the name of a genus and species, Gen. Lyman opposes the view of Dr. Lütken, the distinguished zoologist of Copenhagen in the following terse language:—

"For instance, we have, in 1854, *Ophiura nodosa* Ltk. I after-

* Illustrated Catalogue of the Museum of Comparative Zoology, at Harvard College. No vi. Supplement to the Ophiuridæ and Astrophytidæ. By Theodore Lyman. Cambridge, 1871. Royal 8vo. pp. 18. With 2 plates.

wards attempted to show that *Ophiura* was preoccupied, and made a name, *Ophioglypha*, to take its place; and the question now is, shall it be written *Ophioglypha nodosa* Ltk. or *Ophioglypha nodosa* Lym? Dr. Lütken has no cause for astonishment. There are two parties to this question. That to which he belongs insists on considering *credit* or *honor* the real reason for using names of authors; and always speaks of the 'injustice' done when an author's name is lost sight of. The party whose views I hold maintains that nomenclature is *a system of exact registration*, and that, with the present enormous mass and confusion of titles, no other guide is possible; and further, that the credit of a zoologist does not rest on his monogram, but on something better. . . . . To sum up, *Astrophyton costosum* Seba, and *Ophioglypha nodosa* Lyman, mean just what they should mean, and nothing more; to wit, that in the writings of these two persons will be found these names definitely used for the *first time*. They do not distinguish these persons as good or as poor zoologists, nor do they show that such names are the correct ones; but they are simply the 'trademarks' of workmen."

We may add that the following rule regarding this subject was adopted (1868) by the Council of the Peabody Academy:—"Voted: that in labelling the collections the name of the person who first united the generic and specific appellations shall be given as the authority for the name, and that when the name of the original describer of the species is given it shall be in parenthesis."

NATURAL HISTORY MISCELLANY.

BOTANY.

The Parasitic Fungi Found in the Human Ear have recently been studied by Dr. Karsten. He confirms the statement made by Hallier and other previous observers, that when the spores of these fungi are sown elsewhere they assume very different forms, according as the matrix on which they are sown is rich or poor in material for nutrition; and that fungi described by early writers as distinct species, or even as belonging to different genera, are frequently merely different forms of the same plant.

Vitality of Cambium Layer of Bark. — Permit me to call attention to a curious fact, relating to the "cambium layer." While spending vacation in Andover, Mass., in July and August of this year, I observed an apple tree upon the premises of Geo. Ripley, Esq., from which the bark had been entirely removed in May, 1870, for the whole distance between the ground and the branches. The tree is about one foot in diameter, and its branches are some seven feet from the ground. Though this tree had been so thoroughly girdled, a new and healthy bark had formed upon its trunk, and the tree appeared vigorous and had a good crop of fruit upon its branches. Upon inquiry, I found that this girdling operation had been performed from no malicious purpose, but for the sake of improving the health and fruitfulness of the tree! I sought the acquaintance of the botanical magician who had proved himself so skilful in producing good from evil, and found him to be an old man of 86 years — Mr. Joseph Davis. He showed me several trees in an adjoining orchard, upon which the same operation had been performed some six weeks previous, each tree manifesting all the signs of healthful vigor and having a new, but very thin bark already formed upon its trunk. Mr. Davis insisted that the removal of the bark should be made about the first of June, when the new wood is most rapidly formed, and that the hand of the operator and every other object should be kept from contact with the stripped trunk for several days. He also stated that a heavy rain storm would kill the tree if occurring within a day or two of the loss of its bark, and pointed out a dead line upon one of the trees, running from the top to the bottom of the trunk, caused by the trickling down of rain produced by a light shower which fell within twenty-four hours of the girdling.

I had never before seen so clear an illustration of the wonderful vitality of the "cambium layer," a portion of which (called "mucilage" by Mr. Davis) must have remained upon the trunks of these trees, and being protected from disturbance performed all the functions of the entire bark, besides speedily restoring the lost portions. — Frank H. Snow, *Lawrence, Kansas.*

Influence of the Period of Fecundation on the Sex of Plants. — The author of the "Vestiges of Creation" advanced the theory that "all beings are at one stage of the embryotic progress female, a certain number of them are afterwards advanced

to be of the more powerful sex;" and Thury of Geneva believed that the moment of fertilization relative to the maturity of the ovule, exercises a decisive influence on the sexuality of the product, the ovules fertilized earliest producing females, and those fecundated at a later period producing males. Professor Hoffmann of Giessen has recently attempted to test the truth of this theory in the case of dicœcious plants, the species on which the experiments were made being *Spinacia oleracea*, *Mercurialis annua*, *Lychius vespertina*, and *Rumex acetosella*. In each case the female plants were separated into two portions, one being fertilized artificially as early as the stigmas were developed, the other after they had been mature for a considerable period. The result of his experiments was, on the whole, decidedly opposed to Thury's theory; nevertheless he found that the period of fecundation had an unmistakable influence on the plant; and also that a remarkable difference exists between the results of artificial and of natural impregnation which he was quite unable to account for.—A. W. B.

Diatoms in the Hot Springs of Nevada.—Dr. Blake exhibited, before the California Academy of Sciences, under a powerful microscope, specimens of Diatoms from a hot spring in Nevada, the temperature of which was one hundred and sixty degrees. Dr. Blake said they were more numerous there than in any other locality, six or eight hundred occurring in a bit of mud the size of a pin's head. Most of them were identical with the fossil species described by Ehrenberg, from near Salt Lake, but many were new. He mentioned particularly the red algæ, living in the spring and found in salt beds in many parts of the world. He found about fifty-two species, of which thirty are the same as Ehrenberg's, who mentions about sixty-eight.

ZOOLOGY.

Fossil Mesozoic Mammals.*—The interest which in the year 1854 centred around the important discoveries of Mr. Beckles in a small and apparently insignificant seam in a scarcely noticeable stratum of the upper Oolitic series has during the past few months risen to satisfaction at our knowledge of the fact that the speci-

* "Monograph of the Fossil Mammalia of the Mesozoic Formation." By Professor Owen, F. R. S., D. C. L. (Printed for the Palæontographical Society. 1871.)

mens derived from the Purbeck beds have been at last fully and entirely described by Professor Owen. Sir Charles Lyell eloquently and suggestively pointed out, with reference to the importance of the Purbeck discoveries, "when the geologist inquires if any land animals of a higher grade than reptiles lived through any one of these three periods, the rocks are all silent, save one thin layer a few inches in thickness. This single page of the earth's history has suddenly revealed to us in a few weeks the memorials of so many species of fossil mammalia that they already outnumber those of many a subdivision of the tertiary series and far surpass those of all the other secondary rocks put together!"

In this locality Mr. Beckles worked for many years at his own expense; and the result was the discovery of an extensive series of fossils, which were placed in the hands of Professor Owen for description. Some of these in the meanwhile were described by other palæontologists; and a controversy was carried on, both in the "Quarterly Journal of the Geological Society" and in some ephemeral publications, as to the nature and value of the principal genus of mammalia that was discovered in the Purbeck "dirt bed."

This species, *Plagiaulax*, contained in itself one of those text-examples on which the truth and verity of all our physiological deductions may rest. And it is rather with a view of offering our readers some notion of the intellectual canons on which a scientific man may determine the affinities of a species than of describing the form itself, that we briefly call attention to what, perhaps, is one of the most interesting genera which modern science has unveiled to us.

The jaw of a very minute animal presented, as was thought by Dr. Falconer, its original describer, some points of analogy with the characters exhibited by the jaw of the kangaroo-rat (*Hypsiprymnus*), and much controversy was expended at the time of its discovery and shortly afterwards, as to the precise value of those features which led one eminent scientific man (alas! since deceased) to affirm from the form of the jaw and shape of one of the teeth that it was an herbivorous animal; while Professor Owen, on the other hand, declared it to be a carnivorous marsupial. That two such eminent men could in this way differ on the most simple, the most elementary, and the most obvious fact in the science, naturally leads students to suspect either that the infallible can-

ons of the science of palæontology must be wrong, or that errors both of fact and of definition must have been committed by one or other of the intellectual combatants.

Varius Sucronensis ait, Æmilius Scaurus negat; utii creditis, quirites?

Though the species of animal, therefore, is of trifling dimensions, and though the technical argument is too complex to be entered into on the present occasion, we must examine how far the canons of the science have been obeyed. Cuvier has said, "La première chose à faire dans l'étude d'un animal fossile, est de reconnaitre la forme de ses dents molaires; on détermine par là s'il est carnivore ou herbivore." The few and small molars of *Plagiaulax*, however, bore no relation whatever to the like molars in any other herbivorous animal; while many other characters—*e. g.* the cutting and salient angle of the molar and premolar teeth; the broad, high, and nearly vertical coronoid process; and the very low position of the articular condyle—amply demonstrate to the satisfaction of Professor Owen and his disciples the absolute reverse of Dr. Falconer's theory. Plausible as the latter was, resting entirely on the apparent resemblance of one solitary tooth (and that one not even a molar) with the premolar tooth of the kangaroo-rat, the words of Owen are amply confirmed, "that the prominent appearances which first catch the eye and indicate a conformable conclusion are deceptive; and that the less obtrusive phenomena which require searching out, more frequently when their full significance is reasoned up to, guide to the right comprehension of the whole. It is as if truth were whispered rather than outspoken by Nature."

The lesson, therefore which students ought to learn is that the true affinities of an animal do not lie on the surface of the specimen; that one solitary premolar tooth is inadequate on which to found a theory of the "saltatory" nature of the animal to which it belonged; and that the theory of Dr. Falconer, adroitly though it has been supported by many apparent or accidental coincidences has not stood its ground before the more elaborate, more profound, and at the same time more simple interpretation of the affinities of *Plagiaulax* originally suggested by Professor Owen.

After the lapse of some years (in fact since 1847) the oldest known mammal is still the *Microlestes* of the Triassic beds of Wurtemberg. This perhaps bears some slight resemblance to

Plagiaulax, although the allegation of affinity between *Plagiaulax* and *Microlestes* rested upon one of those "hasty blunders" which detract from the safe and accurate progress of any science. Professor Owen we believe on one occasion ("Palæontology," 1st edit., p. 302; 2nd edit., p. 339) pointed out that some of the teeth of *Plagiaulax* bore resemblance to some teeth in *Microlestes*, in a sentence which was plainly and lucidly expressed. The incapacity as it seems, to apprehend the meaning of an ordinary sentence leads us also to doubt the capacity of judging of the nature or degree of the demonstration of the affinity of *Plagiaulax* to *Hypsiprymnus* which a superficial observer may believe himself to find in the more exact writings of Falconer or Flower.

Relegating, therefore, the unhappy little jaw of *Plagiaulax* far away from the sect of the "Jumpers" (*Saltantia*) to its proper position in the scale of insect or flesh feeding marsupials, associated with its congener, the large marsupial tiger of Australia (*Thylacoleo carnifex*), the affinities of which as a *bona fide* carnivore Professor Owen also amply proves, we have to glance at the number of new forms of animal life described by Professor Owen in the present memoir. Eight new genera of mammalia and seventeen new species are described in detail, all of which afford marked points of distinction from anything of which the palæontological student in his wildest day dreams could have ever realized. Nearly all of these forms are unquestionably marsupial and allied to the pigmy "opossums" of Australia, differing not only from each other, but from anything previously known to science. We can only wonder at the enormous amount of variety of "differentiation" which appeared at so remote a period of the earth's history, and the mode in which the places which nowadays in the Dorsetshire fields are filled by moles, hedgehogs, and shrewmice, were, at the time of the deposition of what is now called the "Purbeck bed" occupied by animals which, while they closely resembled in many of their characters the existing opossums, yet differed from them in retaining the more "generalized" type, from which it is not merely rational but probable to believe that our forms of marsupial animals existing at the present day have sprung.—*Pall Mall Budget*.

Former Eastward Range of the Buffalo.—The occurrence of the buffalo in Virginia up to the close of the last century, can

be substantiated beyond question. Surgeon J. Simpson, U. S. A., who was well acquainted with Nathan Boone (son of Daniel Boone the pioneer, and then a captain in the service*), informs me that he had the fact, in 1843, from Nathan Boone himself, who killed Buffalo in Virginia in 1793–'97–'98.

Dr. Simpson has handed me a letter addressed to him by Dr. Charles McCormick, Surgeon U. S. A., dated Fort Gibson, Cherokee Nation, August 18th, 1844, in which the particulars are given. The occasion for that part of the letter which relates to the buffalo arose in this way:—An officer to whom Dr. Simpson mentioned Capt. Boone's statements being inclined to doubt them, Dr. Simpson wrote to Dr. McCormick, desiring the latter to ask Capt. Boone, who was then at Fort Gibson, to put the facts in writing. This, it seems, Capt. Boone promised to do, but neglected to keep his promise, owing, probably, to the singular indisposition of men of his class to put anything on paper. The following extract, however, from the letter in question, is sufficient:—

"I have just seen Capt. Boone," writes Dr. McCormick, "and he promises to write and tell you all about it. In the meantime, he says he killed his first buffalo, somewhere about 1793, on the Kenawha in Virginia. He was then quite a small boy. He has also killed buffalo on New River and near the Big Sandy in Virginia in '97 and '98."

I have thought best to be thus circumstantial in detail of persons, places and dates, in order to fix precisely an important item in the natural history of our country. But this occurrence of the buffalo in Virginia is only of a part with its general former range, as attested by accounts of other observers.—Elliott Coues, *Fort McHenry, Md.*

Land Shells of Western Massachusetts.—In Vol. I. of the Naturalist, was published a paper on the "Land-Snails of New England." During the following summer I was myself engaged in making a small collection of the land-snails found at West Stockbridge, Berkshire Co., Mass., and to my surprise, many of my results were directly at variance with those given by Mr. Morse in the above-mentioned article. The reason for this difference was

*Captain of Rangers, 23 March, 1812; out of service to June 16, 1832; then made Captain of Mounted Rangers; Lieutenant Colonel, 2d U. S. Dragoons, July 25, 1850, and until death at Springfield Illinois, July 15, 1853.

apparent when I considered my locality. Berkshire Co. occupies the extreme western end of Massachusetts, and therefore its fauna closely resembles that of New York; and further, it is eminently a limestone country, and for this reason, the land-snails exist in wonderful abundance. Frequently in a morning's walk I have met with twenty or thirty of the larger species and quite a number of the smaller ones. *Helix fuliginosus* Binney and *H. inornata* Say were found in great abundance and in nearly equal numbers. In some localities, near the marble quarries, I found *H. alternata* Say in wonderful profusion, but in general it was an uncommon shell. *H. tridentata* Say, of which Mr. Morse says, it "occurs only rarely in the western part of Mass.," was very common in my immediate vicinity. Next to *albolabris*, *inornata* and *fuliginosis*, it was the most common shell found. *H. monodon* was rather rare; *hirsuta* was still more so, as between myself and a friend collecting with me, we only obtained three or four specimens. Of *H. palliata*, recorded as being found at "Copperas Hill, Vt.," I found one perfect specimen; of *H. Sayii*, I found five or six perfect specimens and several bleached ones. Of the smaller shells, none could be considered common except *H. labyrinthica*, and *Zua lubricoides*. The former I found most common on moss-covered rocks, comfortably packed away in the moist earth and roots, between the moss and the rock. The latter were always found at the base of rocks, among the moist leaves and in the earth itself. Judging from the collections made by myself and friend, I should say that the relative abundance of snail shells in that locality is expressed in the following numbers: *H. fuliginosis*, ten; *inornata*, ten; *tridentata*, five; *albolabris*, four; *alternata*, three; *monodon*, three; *labyrinthica*, two; *Zua lubricoides*, two; *H. Sayii*, one; all others only occasional. This excludes the locality where *alternata* was so plenty; if that be counted, it would place that species at two or three times all the others combined. I have given these notes because they show how much local variation may exist in the distribution of the land shells, and how much the extreme western part of Mass. resembles the Middle or Western States, so far as its snail-life is concerned.—W. G. Freedley, *Philadelphia*.

Conchological Notes—Mr Stearns called the attention of the California Academy of Sciences to the indefiniteness and errors in the catalogues of various families of the Mollusca, which are being

published by the Conchological Section of the Academy of Sciences of Philadelphia; these faults occur in the *habitat* of many of the species, while no new light has been thrown upon their geographical distribution. In some instances, certain West American species which he named, had a range of a *thousand miles* further north than credited in the catalogues, and in some cases species had been credited to this coast that were exotic and whose true station was *thousands of miles* away. Such errors by an American author in connection with American species, were to say the least discreditable; the errors of Reeve, Sowerby and Kiener were repeated, while the labors of our own authors were practically ignored, and their more accurate work though equally accessible, was overlooked. He presented a paper upon the subject for publication.

Mr. Stearns also gave a description of the animal of Trivia Californica, with blackboard illustrations of the same, and of the corals upon which it feeds; worn beach specimens of this Trivia are the *T. depauperata* of Sowerby.

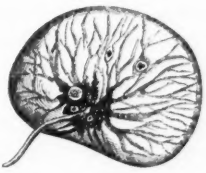
The Fauna of Lake Superior at Great Depths. — An examination of the fauna of the depths of Lake Superior has been undertaken the past season by the U. S. Lake Survey, and dredging in different parts of the lake has been conducted by Mr. S. I. Smith. In all the deeper parts of the lake examined, the bottom is composed of fine clay, or clayey mud, apparently unfavorable to a great variety of life. The principal animals obtained below one hundred fathoms were, a species of Hydra, several worms, species of Ostracoda, with a few other forms of Entomostraca, one or two species of Amphipoda, a species of Mysis,* insect larvæ belonging to the dipterous genus Chironomus and a species of Pisidium. In the more shallow waters, a much greater variety of animals was obtained. The species of Mysis was found at a number of points from eight to one hundred and forty-eight fathoms, and Mr. Smith regards its occurrence only as evidence that Mysis is another to be added to the list of genera common to fresh and salt water. Dredging was carried on down to one hundred and sixty-nine fathoms, the deepest known point in the lake, and water brought up from that depth was perfectly fresh. The temperature in all the deeper parts of the lake is near 39°, or about that of the maximum density of fresh water.

* *Mysis relicta* Lovén, and *Pontoporeia affinis* Lindst., both living in Lake Wetter in Sweden!

Sensitive Surface in Mouse's Ear. — We learn from the "Quarterly Journal of Microscopy" that Dr. Schobl, who lately published a remarkable paper on the wing of the bat, has made similar researches on the ear of the white mouse, with very interesting and surprising results. The first thing which attracted his attention was the immense richness of the ear in nerves. Even the bat's wing is but poorly supplied in comparison. Calculating from the average size of the ear of a common mouse, he found that there are on the average 3,000 nerve terminations on each of its surfaces, making 6,000 on each ear, or 12,000 altogether. The function of this elaborate arrangement would seem to be, like that in the wing of the bat, to supply by means of a very refined sense of touch the want of vision to these subterranean animals.

Development of Noctiluca. — All that has been known as to the mode of development of this minute animal (Fig. 121), that causes a great part of the phosphorescence of our seas, is that they multiply by division and internal bu ding. Prof. Cienkowski, as the "Quarterly Journal of Microscopy" states, has traced the ormation of spores like those of some fungi, and seen them swimming around like the zoospores of sea weeds. He has also observed the mode of sexual union of these animals.

Fig. 121.



Relations of Embryology to pathology. — Dr. Dohrn reviews in the "Academy" some observations made in the Pathological Institute of Jena by Prof. W. Müller, and published in the "Jena Zeitschrift." The papers contain a singular mixture of embryology and pathology, and embrace a field of comparative embryology that has hitherto remained wholly uncultivated. In regard to the chorda dorsalis, Müller shows that it plays a secondary part in the formation of the skeleton of Vertebrates. We can very well imagine animals, Dohrn says, with bones in their interior, and even animals with a vertebrate skeleton, which present no traces of a chorda, while on the other hand we may meet with the chorda in invertebrate animals, such as the larvæ of Ascidians, which develop no trace of an internal skeleton.

Müller's papers also show that a new era in pathological anat-

omy is dawning, since comparative anatomy and embryology will aid in recognizing the nature of pathological processes and formations. Dohrn insists that "in addition to anatomy and physiology, which are subjects of equal importance, embryology and comparative anatomy should also be regarded as absolutely essential to the completion of medical education" and urges that a new and special chair be devoted to these subjects in medical universities and schools; and if this be a necessity for Germany, where the study of the history of development has of late years received such great extension, it holds still more for England, where scarcely any embryology is taught or made an object of study. How lamentably deficient our own medical schools are in these branches is sufficiently apparent.

Cause of Phosphorescence in Animals. — M. Panceri presented to the recent congress of naturalists and physicians at Turin (Italy) the results of some investigations as to the cause of phosphorescence in animals, and especially in fishes. He has come to the conclusion that the cause of this phenomenon is the slow oxidation of fat, which he finds to be always present when the phosphorescence is observed in animal substances. In the case of fish the oxygen of the air very readily penetrates the skin, and acts upon the subcutaneous adipose tissue. The phenomenon is promoted by placing the phosphorescent substance in oxygen, but is entirely arrested by its immersion in carbonic acid, fresh water, alcohol, or any solution not containing oxygen. Phosphorescence usually commences immediately after death, and continues until decomposition sets in, with disengagement of ammonia, when it invariably ceases. — A. W. B.

Pieris rapæ Parasite. — It will doubtless be an interesting item of intelligence to many of the readers of the Naturalist, that the parasite, so anxiously looked for, as the only hope of preserving the cabbage crop of our country from the destruction threatened it by the ravages of *Pieris rapæ*, has already entered upon its labors, and in so efficient a manner as to promise immediate beneficial results.

During the latter part of September, I was informed that a number of chrysalides of *P. rapæ* which had been collected by a gentleman in this city, with a view of obtaining specimens of the

images for drawing, instead of disclosing the butterfly, gave out a number of small flies from each. Some of them having been brought to me in compliance with my request, I was delighted to find them to be of the genus *Pteromalus* which includes so many of our valued parasitic friends, and probably of the species which has been found so serviceable in Europe, in destroying the several cabbage butterflies there existing — viz., the *Pt. puparum* of Linnæus.

From the close resemblance which many of the *Pteromali* bear to one another, it is not safe to assert positively that we have really been favored with the importation of the European parasite, to aid in the work of subjugation of the European pest, but should further examination prove this to be the case, it will be not only a most interesting event in its scientific aspect, but also in the pecuniary results which must necessarily follow it.

In another number, I may give your readers the observations — quite limited, I regret — which I have been able to make on this welcome parasite. — J. A. Lintner, *N. Y. State Museum of Nat. Hist.*

[We have also raised this parasite in considerable abundance and also received specimens from Vermont. We have likewise reared a Dipterous parasite from the cocoons. — Eds.]

The Fauna of Madagascar. — M. Alfred Grandidier has recently returned from his third voyage of discovery to Madagascar, and has shown that the riches and eccentricities of its fauna have not yet been exhausted. His collections, which have only recently reached the Jardin des Plantes at Paris, although brought to France before the political storm of last year commenced, have not yet been fully examined. But they are said to include very full series of several species of Lemuridæ, the comparison of which is likely to lead to important results, besides examples of a new genus of Rodentia, and many other mammals of high interest. M. Grandidier has also paid much attention to the fossil deposits of Southern Madagascar, which contain the remains of the extinct gigantic bird, *Æpyornis maxima*, and has arrived at some important results (such as the former presence of Hippopotamus in Madagascar), which may ultimately tend to modify some of the views generally held concerning the true nature of the fauna of this island and its origin. — A. W. B.

WALDHEIMIA SEPTIGERA AND TEREBRATELLA SEPTATA IDENTICAL. *To the Editors of the American Naturalist.* Sirs:—Having in the course of a too short visit to North America been honored by remarkable kindness and attention on the part of my brother naturalists in this great hemisphere, I am rather disappointed at seeing in your excellent periodical a notice of the report submitted to the Royal Society of London by my colleagues and myself on the deep-sea exploration of parts of the North Atlantic, in H. M. S. Porcupine, during the summer of 1869. The writer of that notice, Mr. W. H. Dall, criticises in what I cannot help considering oversevere terms my views "in regard of the specific and generic limits of animals;" and he gives as an instance, *Waldheimia septigera* and *Terebratella septata*, which he states belongs to different genera, although I have included both under the same specific name. I do not agree with Mr. Dall in his statement. Having had opportunities of examining the types or original specimens of *Terebratula septigera* Lovén, at Stockholm, and of *Terebratula septata* (Philippi), at Berlin, and having carefully compared these specimens with the published descriptions and figures, I am convinced that both belong not only to the same genus, but to the same species. What seems to have been in the mind of Mr. Dall when he penned his hasty critique, was that Professor Seguenza of Messina had referred a species of *Terebratella* from the Sicilian tertiaries to Philippi's species, and a species of *Terebratula* found in the same formation to Lovén's species. The former may be the *Terebratella Mariæ* of Mr. Arthur Adams from the Japanese seas; the latter I have ascertained to be rather widely distributed in the North Atlantic. I have the honor to be, Sirs, your very obedient servant.

J. GWYN JEFFREYS, *Montreal, Oct.* 6, 1871.

AFFINITIES OF COCCOLITHS AND OF SPONGES.—Mr. H. J. Carter has enunciated the theory that the coccoliths and coccospheres which are found in deep-sea mud, and have recently been identified as a constituent of some very ancient geological strata, are not, as held by Prof. Huxley, lowly formed animal organisms, but are of vegetable origin. This theory will, the writer considers, explain the apparent anomaly of the presence in deep seas of a large amount of animal life without vegetable organisms for their subsistence. To the same magazine in which this theory is propounded, the "Annals and Magazine of Natural History," the

same authority contributes a paper on the ultimate structure of the calcareous sponges, confirming what has already been written on the same subject by Prof. H. James Clark of Lexington, Ky. The opinion of these two writers is, that the sponges as a group are most nearly allied to the Flagellate Infusoria, and not, as Prof. Hæckel has proposed, to the Cœlenterata. Mr. Carter has expressed his opinion that they are more closely related even to the compound Tunicata, a view which is, however, dissented from by Mr. W. S. Kent, who regards them as a distinct group of the Protozoa, allied on the one hand to the Flagellate Infusoria, in virtue of their uniciliated and funnel-bearing cells, and on the other to the simpler Rhizopoda, in the presence of the general pervading sarcode layer, subservient to the secretion of the common supporting skeleton. While opposed to Prof. Hæckel's proposition of uniting the Spongiadæ and Cœlenterata under one sub-kingdom, Mr. Kent does not deny to the latter the position of the next round of the ladder in the ascending scale of organized beings, though he at present considers there are too many links missing to permit of their fusion. — A. W. B.

Lacordaire's Coleoptera. — I learn from that agreeable source of entomological information, the "Petite Nouvelles Entomologiques," that M. Chapuis has undertaken to complete M. Lacordaire's great work, which was interrupted by the lamented death of its talented author. M. Chapuis wishes to obtain specimens of the following genera, in which he is still deficient: — Megamerus, Prionesthis, Rhynchostomis, Atalesis, Ametella, Chiloxena, Polyoptilus, Macrolema, Eubaptus and Ateledera, etc. I am informed that our friend, Mr. J. S. Baly, who possesses the finest collection of Chrysomelidæ in the world, has offered it to M. Chapuis to make every use of; and I trust other entomologists will follow so generous an example. — *Newman's Entomologist.*

The Stilt Sandpiper in Massachusetts. — A single specimen of this species, *Micropalama himantopus*, was taken here by Albert E. Mills, at Blacksmith pond, July 24, the present year. This is the first recorded instance of its capture in this State, although its occurrence had been anticipated. (Proceedings Essex Inst., V, 294, and Amer. Nat., III, 639.) It was in company with a solitary sandpiper, *Rhyacophilus solitarius*, which was also secured. Both were adult females. — Otis Fuller, *Needham, Mass.*

Gigantic Salamander from China. — Father David, a missionary priest of the order of Lazarists, for many years resident at Pekin, and an enthusiastic naturalist, has discovered in China, besides several new and extremely interesting species of animals, a gigantic aquatic salamander, allied to the great Sieboldia of Japan. The remains of a closely allied reptile (Andrias) are found in the tertiary fresh water deposits of Central Europe.

New Habitat of Helix lineata. — Among the North American landshells that are remarkable for a wide range of distribution is the little *Helix* (Hyalina?) *lineata* of Say, already credited with a range in latitude from "Gaspé to Texas," with a longitude from the Atlantic to "New Mexico." I was much surprised to find specimens in a box of Helices recently collected on the banks and in the neighborhood of Salmon River, Idaho, and sent to me by Henry Hemphill, Esq. The internal peripheral teeth I should judge to be coincident with varical development or periodical growth, and rather eccentric in occurrence and number; not always being in "pairs"* — but sometimes showing only one. — R. E. C. Stearns.

New Entomological Books. — The 14th fasciculus of Mulsant's "Opuscula Entomologica" is just published. The 3rd volume of the "Natural History of the Hemiptera of France" will be ready in a few days, and will contain four tribes. M. Mulsant has published the new edition of his "History of the Lamellicorns of France," as well as the 1st part of the "Staphylinidæ." A new edition of the "Iconography and Natural History of Larvæ of Lepidoptera," by MM. Duponchel and Guenée, is about to be issued: the work gives descriptions and figures of a great number of the larvæ of European Lepidoptera, of course including English species; these figures are contained in ninety-three plates. excellently coloured: the work is published in forty fasciculi, at one franc each. Of the Iconography and Description of unpublished Lepidoptera of Europe, by P. Millière, twenty-five fasciculi have been published, and these contain more than a thousand descriptions of larvæ, pupæ and perfect insects, with the plants on which the larvæ feed, and other details of their life-history: the work is worthy the support of all lovers of the science; nothing

*Vide Binney and Bland's Land and Fresh Water Shells of North America, Part I. p. 82, fig. 84. — Smithson. Pub.

can exceed the delicacy and finish of the figures.—*Newman's Entomologist.*

GEOLOGY.

THE DRIFT PERIOD.—In a paper read at the Lyceum of Natural History, New York Oct. 24, 1870, Prof. Newberry observed:—In the sequence of events included in our Drift period there is a marked break, a middle period, during which, over most of the north-western states, no Drift deposits were made, and when most of this area was covered with a forest growth and sustained many and large animals. At a subsequent period, all parts of this area, less than five hundred feet above the highest of our present great lakes was submerged, and most portions of it covered to greater or less depth, with new Drift deposits, clays, sands, gravel and boulders, a large part of northern and remote origin. Nearly all the large boulders of the Drift belonging to this later epoch are sometimes of great size (one hundred tons) and have been *floated* to their present positions, as they overlie undisturbed stratified sands and clays, which would have been broken up and carried away by glaciers or currents of water moving with sufficient velocity to transport these blocks. Hence they must have been floated from the Canadian highlands, the place of origin of most of them, by *icebergs*. This epoch of the Drift period I have therefore termed the Iceberg Epoch. During this epoch the submergence of the land in the interior of the continent, was greater than in the epoch of the deposition of the Champlain and Erie clays, and all the area north of the Ohio was covered with water up to a height of over five hundred feet above Lake Erie, or one thousand one hundred feet above the ocean level. The highlands of south eastern Ohio, and most of the country south of the Ohio river were not covered by this flood and now bear no drift deposit of any kind. Tracing out the line of ancient water-surface, we find that the depression was greater towards the north, so that the Alleghanies and their foot-hills, and also a wide area of comparatively low country in the southern states formed not only a shore, but a continental limit to the great interior iceberg-ridden sea of the later Drift Epoch. In the western reaches of this sea, which was of fresh water in the later centuries of its existence, was deposited the Löess or "Bluff" which I have elsewhere desig-

nated as the later lacustrine, non-glacial drift. During the deposition of the Löess the interior sea was already narrowing and growing shallower by the cutting down of its outlet or by continental elevation, or both. The descent of the water-level and decrease of water-surface have been going on perhaps constantly, but not uniformly, to the present time, when the area of the great lakes is the insignificant eighty-five thousand square miles it now is. In the descent of the water-level, retarded at certain periods, terraces and beach lines were formed at various places by the shore waves. With these history begins. This then is the classification I would suggest of the drift deposits as they occur in the valley of the Mississippi, premising that here, as in other geological periods, the column is nowhere absolutely complete:—

Period.	Epochs.	Strata.	Notes.
Quaternary.	Terrace.	Terraces, Beaches, Löess.	Sand and gravel beaches with logs, leaves, and fresh-water shells. Löess with fresh-water and land-shells.
		Iceberg Drift, Löess.	Boulders, gravel, sand, and clay, drifted logs, elephant and mastodon teeth and bones.
		Forest Bed.	Soil-peat with mosses, leaves, logs, stumps, branches, and standing trees, mostly red cedar. Elephas, mastodon, Castoroides, etc.
	Glacial.	Erie Clays.	Laminated clays with sheets of gravel, occasional rounded and scratched northern boulders, many angular pieces of underlying rocks.
		Glacial Drift.	Local beds of boulders and rarely boulder clay resting on the glaciated surface.

From the above table it will be seen that the remains of elephant, mastodon, and the gigantic beaver, occur in the forest-bed and in all the succeeding drift deposits. It should also be said that they are found in still greater abundance in peat-bogs and alluvial deposits which belong to the present epoch. We have seen that the submergence of the later drift epoch, though so widespread, left a large part of the area lying between the Mississippi and Atlantic uncovered. This area the elephant, mastodon, great beaver, etc., inhabited during the continuance of the flood that covered the forest bed. From this retreat they issued with the subsidence of the water, following the retreating shore-line, till they occupied all the region now exposed about the great lakes.

By what influence they finally became extinct, we cannot yet say. It has been claimed that they continued to exist down to the advent of man, and that he was an agent in their destruction. This statement may be true but requires further proof before it can be accepted with confidence. The vegetation of the forest bed indicates a cold climate, thus confirming what we had otherwise learned of the habits of the extinct elephant. He was clothed with long hair and wool, was capable of enduring, and probably preferred a subartic climate, and was associated in this country as in Europe, with the musk ox and the reindeer. We may therefore infer that progressive increase in the annual temperature, drove most of the animals of the Forest-bed northward, and caused to gather on the shores of the Arctic sea, the herds of elephants whose remains so much impress all travellers who visit that region. This was probably the scene of the last vigorous and abundant life, and of the death of the species; an event consequent, perhaps, on the action of local causes, which we shall comprehend when we have opportunities of studying the record. One remarkable statement in regard to the Forest-bed requires notice. In more than one instance, parties digging wells in south-western Ohio, have reported not only that they found a black soil and logs, but "some of the logs bore marks of the axe, and were surrounded with chips." These stories I formerly rejected as pure fabrications; but in the light of recent observations, they seem to me to be in part true, and not difficult of explanation.— *Nature.*

The Structure of Fossil Cryptogams.— At the recent meeting of the British Association for the Advancement of Science held at Edinburgh, Prof. W. C. Williamson read a paper in which he suggested a new mode of classification of fossil cryptogams. He proposes to separate the vascular cryptogams into two groups, the one comprehending Equisetaceæ, Lycopodiaceæ and Isoetaceæ, to be termed the Cryptogamiæ Exogenæ, linking the Cryptogams with the true Exogens through the Cycads; the other, called the Cryptogamiæ Endogenæ, to comprehend the ferns, which will unite the Cryptogams with the Endogens through the palms. He considers the fossil arborescent Cryptogams allied to Lycopods including the Lepidodendra, Stigmariæ, Sigillariæ, etc., to be true cryptogams with an exogenous woody axis, and not entitled to the epithet of Acrogens. They differ from ferns in not having closed

fibro-vascular bundles; but their growth results from the development, within the stem, of a vascular woody cylinder, which grew thicker year by year, such thickenings being the result of additions to the exterior of the previous growth. Professor Williamson's theory was, however, sharply contested by Mr. Carruthers and Professors NcNab and Dyer, who adhered to the old view of the essential identity of structure of all woody cryptogamous stems. — A. W. B.

Supposed Vegetable Fossils. — At a recent meeting of the Geological Society of London, Mr. W. Carruthers enumerated a number of bodies which he believes to have been erroneously described as vegetable fossils. Among these are dendritic markings which have been treated as foliage; two genera and three species of supposed fossil fruits which are really impressions of air-bubbles in moist clay; reptilian eggs in the Stonefield Slate and Wealden of the Isle of Wight which have been considered to be fruits; and the curious prehensile hooklets, arranged in rows on the arms of a calamary, found fossil in the lithographic stone of Solenhofen, which have been figured and described by Count Sternberg as a fossil vegetable. — A. W. B.

The Geology of the White Mountains. — The geology of these mountains is most intricate. It is not known whether its granite and slate rocks are of Laurentian, Silurian, or Devonian age alone, or whether all of these formations may not be represented. Prof. C. H. Hitchcock, the state geologist of New Hampshire, has made the interesting discovery of upper Silurian corals in Littleton, N. H. The limestone containing these corals has been traced for about three miles, and appears to be overlaid by a clay slate, containing a few worm trails. The limestone rock appears identical, as we learn from the "American Journal of Science," with that cropping out upon Lake Memphremagog.

Origin of Ocean Currents. — It seems that the views of ocean currents advocated by Prof. Carpenter were first recognized by Prof. J. D. Dana, in 1852, in the reports of "Wilkes's Exploring Expedition" and the "American Journal of Science." Prof. Dana remarks that facts elicited by Carpenter from deep sea explorations "remove all remaining doubt with regard to the universality of the movement and the oneness of the system. At the same

time there does not appear to be any good reason for separating from the system the Gulf Stream, as is done by Dr. Carpenter." Prof. Dana also seems to agree with Croll as to the thermal work of the Gulf Stream.

NEW CARBONIFEROUS SPIDER.—Mr. Woodward describes, as stated in "Nature," from the Dudley coal field, a Phrynus-like spider which he named *Eophrynus Prestvicii*. A fossil Lycosa-like spider had previously been found, also a Phalangium-like species from the same formation. The present animal represents a third group of Arachnids which lived during the Coal period.

SINGULAR ALBINO.—The Museum of the Agricultural Department at Washington, contains an "albino" Bob-o'-link (*Dolichonyx oryzivorus*), shot in that vicinity, illustrating a rare and curious condition. It is of a uniform clear pale *yellow*, exactly like a canary-bird.—ELLIOTT COUES.

MICROSCOPY.

PROCEEDINGS OF THE SECTION OF MICROSCOPY OF THE BOSTON SOCIETY OF NATURAL HISTORY, OCT. 11, 1871.—Mr. Greenleaf stated in reference to the living Amœbæ shown at the last meeting, that he had not found the slightest trace of any return movement in those organisms. He had seen a central forward current, but never the two return side currents, so often described. He considered these merely optical.

Mr. Stodder said he had tried collecting germs from the atmosphere. He had always found great difficulty in obtaining microscopically pure distilled water. This last summer he had used a glass vessel filled with ice, on which the moisture of the air condensed outside. In this manner nothing not in the air was obtained. In his examinations he had followed the method given by Dr. Maddox in the Feb. (1871) number of the "Monthly Microscopical Journal."

He first placed his germs in molasses, but subsequent examinations showed that this contained germs of its own. He next took pure crystals of sugar dissolved in the water collected, and placed on a slide. To keep the moisture present he had used the method given by Dr. Maddox.

His first collection, made Aug. 11, developed in a few weeks sphores, mycelium, and spores of fungi in great abundance. Other collections of the same date have as yet developed but little life. He had found that in these experiments no animal life was developed.

Mr. Greenleaf showed a slide with a small hole drilled in the centre. By resting the slide on the edge of a shallow tray containing water, so that the hole shall be below the water level, we have a self-supplying water cell, which is completed by placing a thin glass cover over the hole.

Mr. Stodder said, "Dr. Woodward has, I think, carried microphotography to greater perfection than any one else. I have here several photographs of great beauty, delicacy and accuracy, taken with high powers and of very difficult objects." He then showed the following: *Amhipleura pellucida*, with Powell and Lealand's so called $\frac{1}{16}$, a Tolles' $\frac{1}{15}$ and $\frac{1}{10}$ and another $\frac{1}{10}$, and Powell and Lealand's $\frac{1}{8}$, and with a Tolles' $\frac{1}{6}$, all immersion lenses, and all magnified to nearly 1000 diam. Also positives on glass of the same objects with Tolles' $\frac{1}{6}$ 920 diam. with eye-piece and 256 without. All these show the transverse striæ distinctly. Also *Stauroneis Stodderi* Greenleaf 1000 diam. and 3750 diam. and *S. Baileyi* with Powell and Lealand's $\frac{1}{16} = 3000$ diam.

Mr. Bicknell spoke of the difficulty of using the microscope vertically, a position which is often necessary in such work as observing living animals in fluid, picking out Foraminiferæ from sand, etc. He had obviated this difficulty by using an ordinary Nachêt camera lucida. By placing the camera on the eye-piece in the usual manner, and looking into the *underside* of the camera, at an angle of about 30° from the horizontal, a perfect view of the objects on the stage of the microscope is obtained. The position is thus very easy and entirely free from the usual constraint attending the use of the microscope when in a vertical position.

Mr. Bicknell also exhibited an achromatic condenser, made in the form of an eye-piece. Dr. Beale in "How to work with the Microscope" has recommended the use of the Kellner eye-piece as a condenser, and says "by stopping off the greater part of the light passing through the condenser, by placing over the upper lens a thin plate with a very small central hole, a great advantage results in working with high powers." In the condenser shown by Mr. Bicknell the amount and direction of the light is controlled

by a revolving diaphragm placed between the lenses in the place where the diaphragm is usually placed in an eye-piece. There are three holes of different sizes for direct light, one hole with a central stop for dark field, which gives an admirable effect with objectives under 30°; and two oval openings, and one oblong opening especially for the binocular. The oval openings are opposite each other and are in use at the same time, giving two oblique pencils of light, converging to a point, and which are very useful for the binocular. This condenser was used with various objectives from $1\frac{1}{2}$ inch to a $\frac{1}{50}$ of an inch, giving ample light for the latter with the highest eye-pieces.

Mr. Bicknell stated that with this condenser and a $\frac{1}{5}$ of only 100° aperture, he had seen the same test object which had required a $\frac{1}{10}$ or a $\frac{1}{12}$ of 150° when used without it.

The State Microscopical Society of Illinois has issued a prospectus of "The Lens," a Quarterly Journal of Microscopy and the Allied Natural Sciences: with the Transactions of the State Microscopical Society of Illinois; the first number to appear on the first of October. It will be an octavo, each number containing at least forty-eight pages of reading matter. Terms, two dollars per annum in advance. Address Charles Adams, Secretary of the Publishing Committee, 1060 Michigan Avenue, Chicago, or the the Editor, S. A. Briggs, 177 Calumet Avenue, Chicago. Though its appearance has been delayed by the fire, we learn that it will soon be issued.

The Use of the Microscope in Studying the Embryology of the Skull.—His work had not direct reference to the subject of teleology, nor to the structure of the tissues; but his object had been to work out the metamorphosis of the skull, and to see the tissues as they begin to differentiate and modify to form the embryo. The subject was a very large one, and had been principally labored at by the great German embryologists. He had spent the last two years in studying the development of the frog's skull, in watching the different and numerous stages which that creature undergoes, and the relations it bears to other creatures of the vertebrate type, always remembering that the frog was essentially a fish. He had been in some degree unprepared for the extent of the metamorphic changes that the frog underwent. He had worked out this subject into ten artificial stages, the first of which he had obtained when the frog was in the egg. In the first stage of its

morphological development the animal was two stages below the youngest *described* embryo of the lowest kind of fish, but one.

The larva of the lamprey was the earliest condition of a fish's skull with which we are acquainted. He had succeeded in getting two stages below the larva of the lamprey. From this stage he had worked up the development of the frog until he came to the tadpole, which is the representation of the types of rays and sharks. As he ascended in the various stages the likeness to the other vertebrata became very apparent. In an adult frog (*Rana temporaria*) he had obtained a metamorphic development of such height that it bordered upon our own class, the Mammalia. At the same time it should be stated that other parts of that frog's skull retained the simplicity of the adult lamprey. In the frog we had a creature who had run across the whole circle of types, creeping gradually up to the Mammalia and yet never losing his relation to the original type, but retaining its structure and relation to the very end, although subdividing and metamorphosing certain of the facial arches into the very number of parts that we have in our own inner ear. The chain of bones in the human ear (the hammer, the anvil, the round bone and the stirrup) had caused a great deal of trouble to anatomists in their attempts to trace the series of metamorphic changes. He had, however, made this clear by tracing the history of the facial bones of a frog, a creature which was but a fish in respect of its earliest embryonic conditions. Supposing the doctrine of development to be true, it would seem that we ourselves have come originally in some line sub-parallel to the frog (he would not say from the frog itself, although man had repeated the form tail-less). Even in the highest oviparous vertebrates no sub-division of a facial bar to form that tiny but really important part of the human skull, the *os orbiculare*, ever obtained. In this respect the frog comes nearer to the Mammalia than any bird. Birds have branched out in a direction quite away from the ordinary line, and have culminated in their own glorious types. If it is desired to trace the development of the Mammalia, inquiries must commence with the Batrachia, and in such inquiries the thought constantly occurs that between us and the Batrachia there have been lost whole groups of creatures. We were only just beginning to see the manner in which the work of tracing the development of the higher forms of animal life was to be carried on. —*From Address of H. W. Parker, before the Royal Microscopical Society, in the Monthly Microscopical Journal.*

NOTES.

The death of Sir Roderick Impey Murchison occurred on the 22d of October, at the age of seventy-nine. He was not a graduate of either of the great universities, but like Faraday, Miller and several other prominent English scientists is said to have had in early life only an ordinary education. He studied at the Military College at Marlow, and was an officer in the army from 1807 to 1816. In 1831 he began to study geology practically and at the end of five years published his celebrated Silurian system. In 1836 he was employed in the geological survey of Russia. He contributed over a hundred memoirs to scientific journals, and was among the first to call attention to the Australian gold fields. He was long President of the Geological Society of London, and at the time of his death was President of the Royal Geological Society.

The U. S. Coast Survey Steamer F. R. Hassler, commander P. C. Johnson, U. S. N., now arrived at Boston, will be despatched as soon as ready to the coast of California for the survey for which she is designed.

Prof. Peirce, Superintendent of the Coast Survey, to make this long voyage by way of the Straits of Magellan as profitable as possible to science, has offered to Prof. Agassiz the direction of a scientific party to sail in her, and pursue during the voyage deep sea researches and investigations in natural history at the different points of stoppage. The party will consist of Prof. Agassiz as director (accompanied by Mrs. Agassiz,) Ex-President Hill of Harvard College as physicist, Assist. L. F. Pourtales of the Coast Survey in charge of deep sea dredgings, Dr. Steindachner as ichthyologist, Mr. Blake as ichthyologist and draughtsman. Some of the officers of the ship have also qualified themselves to assist in various researches. The point at which the steamer will probably stop will be Bermuda, Trinidad, Rio Janeiro, Montevideo, the Falkland Islands, the Straits of Magellan, Juan Fernandez, the Gallapagos. The ship is fitted out with a special view to deep sea soundings and dredgings, and with all possible contrivances for catching fish, etc.

ANSWERS TO CORRESPONDENTS.

E. M. B.,—The *Sesia pelasgus* is described in Morris's Synopsis of the Lepidoptera of U. S. published by the Smithsonian Institution.

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